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Annual Groundwater Report 2019

Santa Clara Valley Water District

Annual Groundwater Report for Calendar Year 2019

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EXECUTIVE SUMMARY

The Santa Clara Valley Water District (Valley Water) is the Groundwater Sustainability Agency (GSA) for the Santa Clara and Llagas Subbasins[1] in Santa Clara County, which are sustainably managed through the comprehensive activities described in Valley Water's 2016 Groundwater Management Plan (GWMP).[2] This Annual Groundwater Report for Calendar Year (CY) 2019 is separate from and more comprehensive than the annual report required under the Sustainable Groundwater Management Act (SGMA). This report describes groundwater use, levels, quality, storage, and land subsidence and presents the status of GWMP outcome measures using recent data. These measures identified in the GWMP are used to evaluate performance relative to Valley Water Board of Directors (Board) Water Supply Objective 2.1.1: "Aggressively protect groundwater from the threat of contamination and maintain and develop groundwater to optimize reliability and to minimize land subsidence and saltwater intrusion."

Groundwater pumping by water retailers and other well users was 110,400 acre-feet (AF)[3], providing 37% of the total water used in the county in 2019. To help sustain and protect groundwater supplies, in 2019 Valley Water:

- Recharged groundwater with 83,500 AF of local and imported surface water,
- Reduced groundwater demands by 195,000 AF through treated surface water and recycled water deliveries and water conservation programs, which collectively provide in-lieu groundwater recharge,
- Conducted extensive monitoring and analysis of groundwater levels and quality, and land subsidence,
- Implemented the well ordinance program and other activities to minimize threats to groundwater quality, and
- Worked with basin stakeholders, land use agencies, and regulatory agencies to protect groundwater resources.

Table ES-1 shows data for key indicators in 2019 as compared to 2018 and prior periods. Having previously fully recovered from the 2012-2016 drought, groundwater levels and storage continued their rise, with an estimated 15,200 AF[4] added to groundwater storage in 2019 since recharge exceeded pumping and other outflows. Groundwater levels in 2019 remained near historical highs in regional index wells and at many other wells around the county. Estimated end of 2019 total groundwater storage was 356,700 AF, which falls well within the normal stage (Stage 1) of Valley Water's Water Shortage Contingency Plan, indicating good water supply conditions.

Groundwater quality remained generally good in principal aquifer zones; median values for Total Dissolved Solids (TDS) were at or below 410 milligrams per liter (mg/L) in all groundwater management areas (Appendix C). Principal aquifer median nitrate values were at or below 4.7 mg/L in all three management areas, below the drinking water standard of 10 mg/L. However, because elevated nitrate persists in individual wells, Valley Water continues to work with regulatory and land use agencies to address this ongoing groundwater protection challenge.

North County Groundwater Summary

Groundwater use in the Santa Clara Plain (the northern Santa Clara Subbasin) was 57,700 AF in 2019, a 9% decrease from 2018. This is below the long-term average of 95,000 AF due to continued lower demand and

[1] California Department of Water Resources (DWR) Basins 2-9.02 and 3-3.01, respectively. Valley Water further divides the Santa Clara Subbasin into two groundwater management areas: the Santa Clara Plain and the Coyote Valley.
[2] Santa Clara Valley Water District, Groundwater Management Plan, November 2016. This plan was submitted to DWR as an Alternative to a Groundwater Sustainability Plan in December 2016 and approved for SGMA compliance in July 2019.
[3] All values presented in this report are based on best available data (measured or estimated) and may be refined as additional data becomes available.
[4] Groundwater storage estimates presented in this report are as of March 2020 and represent accumulated storage as described further in Chapter 3. Storage estimates are updated as additional data becomes available.

increased use of treated surface water by water retailers. Pumping locations and uses remained relatively stable, with nearly all (99%) groundwater used for municipal and industrial (M&I) purposes.

Groundwater levels remained fully recovered from the 2012-2016 drought, with water levels in many wells at or above historical highs. Groundwater levels are also well above the minimum water level thresholds established to protect against land subsidence. Land subsidence data for 2019 indicates uplift, reflecting healthy groundwater conditions. Estimated groundwater storage at the end of 2019 was 315,700 AF, which was 6,300 AF higher than 2018.

North County groundwater continues to have very good quality overall. In 2019, 99% of water supply wells tested met all health-based drinking water standards. Public water systems must comply with drinking water standards, which may require treatment or blending prior to delivery.

South County Groundwater Summary

In 2019, groundwater pumping in the Coyote Valley (the southern Santa Clara Subbasin) and Llagas Subbasin was 11,100 AF and 41,600 AF, respectively. Pumping decreased by 8% in the Coyote Valley and by 4% in the Llagas Subbasin compared to 2018. Most pumping in the Coyote Valley was for M&I uses (72%), with smaller amounts for agricultural (26%) and domestic (2%) uses. In the Llagas Subbasin, 56% of total pumping was for agriculture, 40% for M&I use and less than 4% for private domestic use. Estimated groundwater storage in South County (Coyote Valley and Llagas Subbasin) at the end of 2019 was 41,000 AF, which is 8,900 AF higher than 2018. Groundwater levels remained healthy and were well above historical lows at regional index wells.

Groundwater quality in South County is generally good, with most water supply wells meeting drinking water standards. However, nitrate continues to be a significant groundwater quality challenge; it was detected above the drinking water standard in 23% of South County water supply wells tested in 2019 (primarily domestic wells). As described in the outcome measure summary below, Valley Water continues to work to address this challenge.

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Table ES-1. CY 2019 Groundwater Supply Conditions Compared to Other Years

Index – Groundwater Supply	2019	Compared to 2018	Compared to 5-Year Average (2015 - 2019)
Total Managed Recharge (AF)	83,500	Down 17%	Down 13%
Total Groundwater Pumping (AF)	110,400	Down 7%	Down 4%
Groundwater as % of Total Water Use	37%	Down 3%	Down 1%
Groundwater Elevations (feet, NGVD88)[1]			
Santa Clara Plain	90.7	Down 1.9 feet	Up 13.2 feet
Coyote Valley	277.2	Up 4.6 feet	Up 5.4 feet
Llagas Subbasin	229.0	Up 5.4 feet	Up 12.9 feet
End of Year Groundwater Storage (AF)	356,700	Up 4%	Up 14%
Land Subsidence (feet/year)[2]	-0.006 (Uplift)	No Change (Uplift)	No Change (Uplift)

Notes:

1. Groundwater elevations are shown for three groundwater management areas: the Santa Clara Plain and Coyote Valley (which comprise the Santa Clara Subbasin) and the Llagas Subbasin. Groundwater elevations represent the average of all readings at three regional groundwater level index wells for the time period noted based on the National Geodetic Vertical Datum of 1988.
2. Valley Water calculates subsidence using the average measured subsidence at two extensometers over the most recent 11-year period. Measured compaction is below the established tolerable rate of 0.01 feet/year, and throughout 2019, water levels at all ten subsidence index wells were above related thresholds established to prevent permanent subsidence.

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Table ES-2. CY 2019 Groundwater Quality Conditions Compared to Other Years

Index – Groundwater Quality[1]	2019 Median[2]	5-Year Step Trend[3]	10-Year Step Trend	15-Year Step Trend
Total Dissolved Solids in Principal Aquifers (TDS, mg/L)				
Santa Clara Plain	410	No Change	No Change	No Change
Coyote Valley	384	No Change	No Change	No Change
Llagas Subbasin	404	No Change	No Change	No Change
Nitrate in Principal Aquifers (as Nitrogen, mg/L)				
Santa Clara Plain	3.1	No Change	No Change	No Change
Coyote Valley	4.2	No Change	No Change	No Change
Llagas Subbasin	4.7	No Change	No Change	No Change

Notes:

1. Groundwater quality indices are shown for three groundwater management areas: the Santa Clara Plain and Coyote Valley (which comprise the Santa Clara Subbasin) and the Llagas Subbasin.
2. Values represent the median groundwater concentration for principal aquifer zone wells tested (both water supply wells and monitoring wells).
3. The median 2019 concentration for each groundwater management area was compared to that of 5 years ago (2014), 10 years ago (2009), and 15 years ago (2004) to determine if there is any statistically significant difference using the Mann-Whitney test at the 95% confidence level.

Outcome Measure Summary

The GWMP identifies outcome measures to assess performance relative to Board policy and groundwater sustainability goals. The status of these measures using 2019 data is shown in Table ES-2 below, along with actions to address measures not being met. All outcome measures related to groundwater storage, levels, and land subsidence were met in 2019. Continued sustainable groundwater supply conditions demonstrate the effectiveness of significant investments in basin management facilities, diverse water supplies, and conjunctive water management, as well as close coordination with water retailers.

Elevated nitrate continues to be the primary groundwater protection challenge in South County, where a significant number of domestic wells contain water with nitrate above the drinking water standard. Valley Water continues to coordinate with land use and regulatory agencies to influence related policies, regulations, and decisions. More directly, Valley Water's managed recharge programs help dilute nitrate, and water quality testing and treatment system rebates help to reduce well owner exposure. While most wells have stable or decreasing long-term chloride concentrations, increasing concentrations in some shallow aquifer wells warrant further evaluation.

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Table ES-3. Summary of 2019 Outcome Measure Performance and Action Plan

Groundwater Storage	**OM 2.1.1.a.** Greater than 278,000 AF of projected end of year groundwater storage in the Santa Clara Plain. **Outcome measure met:** End of 2019 groundwater storage is 315,700 AF.
	OM 2.1.1.b. Greater than 5,000 AF of projected end of year groundwater storage in the Coyote Valley. **Outcome measure met:** End of 2019 groundwater storage is 12,800 AF.
	OM 2.1.1.c. Greater than 17,000 AF of projected end of year groundwater storage in the Llagas Subbasin. **Outcome measure met:** End of 2019 groundwater storage is 28,200 AF.
Groundwater Levels and Subsidence	**OM 2.1.1.d.** 100% of subsidence index wells with groundwater levels above subsidence thresholds. **Outcome measure met:** All ten wells had groundwater levels above thresholds in 2019.
Groundwater Quality	**OM 2.1.1.e.** At least 95% of countywide water supply wells meet primary drinking water standards. **Measure not met:** Only 87% of water supply wells tested in 2019 had water that met primary drinking water standards due to elevated nitrate, mainly in South County domestic wells. If nitrate is not included, 100% of water supply wells met primary drinking water standards. **OM 2.1.1.f.** At least 90% of Coyote Valley and Llagas Subbasin wells meet Basin Plan agricultural objectives. **Measure met:** All wells (100%) had water that met agricultural objectives.
	Action Plan for OM 2.1.1.e: Implement Salt and Nutrient Management Plans to address nitrate, continue free domestic well testing and nitrate treatment system rebate programs, and continue collaborating with regulatory and land use agencies to address nitrate loading.
Groundwater Quality Trends	**OM 2.1.1.g.** At least 90% of wells have stable or decreasing concentrations of nitrate, chloride, and total dissolved solids. **Measure partially met:** This measure is not met for chloride, with 82% of wells having water with stable or decreasing concentration trends. The measure is met for nitrate and total dissolved solids, with stable or decreasing concentrations observed in 91% and 94% of wells, respectively.
	Action Plan for OM 2.1.1.g: Implement Salt and Nutrient Management Plans to address salt loading, continue collaborating with regulatory and land use agencies.

Status of Sustainable Groundwater Management Act (SGMA) Compliance

In July 2019, DWR released their assessment of fifteen Alternatives to a Groundwater Sustainability Plan (GSP) submitted for SGMA compliance by Valley Water and other agencies. DWR approved Valley Water's GWMP for the Santa Clara and Llagas Subbasins, finding it satisfies the objectives of SGMA. The next five-year update of the GWMP must be submitted to DWR by January 2022. Valley Water has submitted three annual reports for these subbasins as required by SGMA, with the most recent submittal (April 2020) included as an appendix to this report.

As the GSA for the small portions of the North San Benito Subbasin[5] in Santa Clara County, Valley Water is supporting San Benito County Water District efforts to develop a GSP for the entire subbasin.

[5] This subbasin is primarily located in San Benito County, where the San Benito County Water District (SBCWD) is the GSA. In 2019, DWR approved a basin boundary modification creating the North San Benito Subbasin through consolidation of several subbasins. The subbasins consolidated into the North San Benito Subbasin include the former Hollister and San Juan Bautista subbasins, which extend into Santa Clara County.

Groundwater Management Plan Implementation

To maintain sustainable groundwater conditions, Valley Water continues to implement the proactive groundwater management activities described in the GWMP. Chapter 6 of this report summarizes the status of the six major GWMP recommendations. Notable progress includes continued investment in high-priority capital projects (including dam safety and purified recycled water), the decision to participate in the California WaterFix[6], and coordination with water retailers and other stakeholders to develop a process to regulate groundwater extraction under SGMA, if needed.

Continued groundwater sustainability is central to the Valley Water mission to provide Silicon Valley safe, clean water for a healthy life, environment, and economy. As such, Valley Water will continue to "aggressively protect groundwater from the threat of contamination and maintain and develop groundwater to optimize reliability and to minimize land subsidence and saltwater intrusion," in accordance with Board policy.

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[6] The project name and scope changed in 2019. The project is now known as the Delta Conveyance Project and focuses on a single tunnel per direction from Governor Newsom.

CHAPTER 1 – INTRODUCTION

The Santa Clara Valley Water District (Valley Water) has the responsibility and authority to manage the Santa Clara and Llagas groundwater subbasins in Santa Clara County per the California legislature.[7] Valley Water also formally became the Groundwater Sustainability Agency (GSA) for these subbasins in 2016. Valley Water's comprehensive groundwater management activities and investments, described in the 2016 Groundwater Management Plan (GWMP)[8], have resulted in sustainable groundwater conditions for many decades. Valley Water's groundwater management objectives and authority under the Santa Clara Valley Water District Act (District Act) are to recharge groundwater basins, conserve, manage and store water for beneficial and useful purposes, increase water supply, protect surface water and groundwater from contamination, prevent waste or diminution of the water supply, and do any and every lawful act necessary to ensure sufficient water is available for present and future beneficial uses.

Valley Water Board of Directors (Board) Water Supply Objective 2.1.1 reflects the mission to protect groundwater resources: ***"Aggressively protect groundwater from the threat of contamination and maintain and develop groundwater to optimize reliability and to minimize land subsidence and salt water intrusion."*** Pursuant to the District Act and Board policy, Valley Water identifies the following basin management objectives in the GWMP[9]:

- Groundwater supplies are managed to optimize water supply reliability and minimize land subsidence.
- Groundwater is protected from existing and potential contamination, including salt water intrusion.

Purpose

This annual report describes groundwater conditions in the Santa Clara and Llagas Subbasins for Calendar Year (CY) 2019 including groundwater use, recharge, water levels, water balance, storage, quality, and land subsidence. The following outcome measures (OM) derived from the GWMP are also assessed to evaluate performance in meeting Water Supply Objective 2.1.1:

- OM 2.1.1.a Greater than 278,000 AF[10] of projected end of year groundwater storage in the Santa Clara Plain.[11]
- OM 2.1.1.b Greater than 5,000 AF of projected end of year groundwater storage in the Coyote Valley.
- OM 2.1.1.c Greater than 17,000 AF of projected end of year groundwater storage in the Llagas Subbasin.
- OM 2.1.1.d 100% of Santa Clara Plain subsidence index wells with groundwater levels above subsidence thresholds.
- OM 2.1.1.e At least 95% of countywide water supply wells meet primary drinking water standards.
- OM 2.1.1.f At least 90% of Coyote Valley and Llagas Subbasin wells meet Basin Plan agricultural objectives.
- OM 2.1.1.g At least 90% of wells have stable or decreasing concentrations of nitrate, chloride, and total dissolved solids.

[7] Santa Clara Valley Water District Act, Water Code Appendix, Chapter 60.
[8] Santa Clara Valley Water District, Groundwater Management Plan, November 2016.
[9] Valley Water submitted this plan to the California Department of Water Resources as an Alternative to a Groundwater Sustainability Plan for Sustainable Groundwater Management Act compliance. The plan was approved in July 2019.
[10] AF = acre-feet. One acre-foot is equal to 325,851 gallons.
[11] As described subsequently, Valley Water divides the Santa Clara Subbasin into two groundwater management areas: the Santa Clara Plain and the Coyote Valley.

The Santa Clara and Llagas Subbasins, located in Santa Clara County, are identified by the California Department of Water Resources (DWR) as Basin 2-9.02 and Basin 3-3.01, respectively (Figure 1). Valley Water divides the Santa Clara Subbasin into two groundwater management areas, the Santa Clara Plain and the Coyote Valley, due to different land use and management characteristics. The Santa Clara and Llagas Subbasins are separated by a groundwater divide near Cochrane Road in Morgan Hill. Groundwater in the Santa Clara Subbasin generally flows toward San Francisco Bay, while flow in the Llagas Subbasin is generally to the southeast toward the Pajaro River. The Santa Clara Plain and Llagas Subbasin have both confined and recharge areas. Within the confined areas, low permeability clays and silts separate shallow and principal aquifers, with the latter defined as aquifer materials greater than 150 feet below ground surface. The recharge areas are unconfined as there are no laterally extensive aquitards forming distinct shallow and principal aquifer zones.

The information in this report is summarized by groundwater management area or by groundwater charge zone (Figure 2). Groundwater charge zones, or groundwater benefit zones, are areas where Valley Water collects fees from groundwater users based on the benefits received from Valley Water groundwater management activities. Zone W-2 (North County) generally coincides with the Santa Clara Plain, while Zone W-5 (South County) generally overlaps the combined area of the Coyote Valley and Llagas Subbasin.[12]

Report Content

In addition to this Introduction, this Annual Groundwater Report for 2019 includes the following chapters:

- Chapter 2: Groundwater Pumping, Recharge, and Water Balance
- Chapter 3: Groundwater Levels and Storage
- Chapter 4: Land Subsidence
- Chapter 5: Groundwater Quality
- Chapter 6: Other Groundwater Management Activities

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[12] In April 2020, the Valley Water Board of Directors approved changes to the groundwater benefit zones that included modifications to the boundary of Zone W-2 and a partitioning of Zone W-5 into three zones effective July 1, 2020. The two zones in effect prior to July 1, 2020 are used in this report.

Figure 1. Santa Clara and Llagas Subbasins

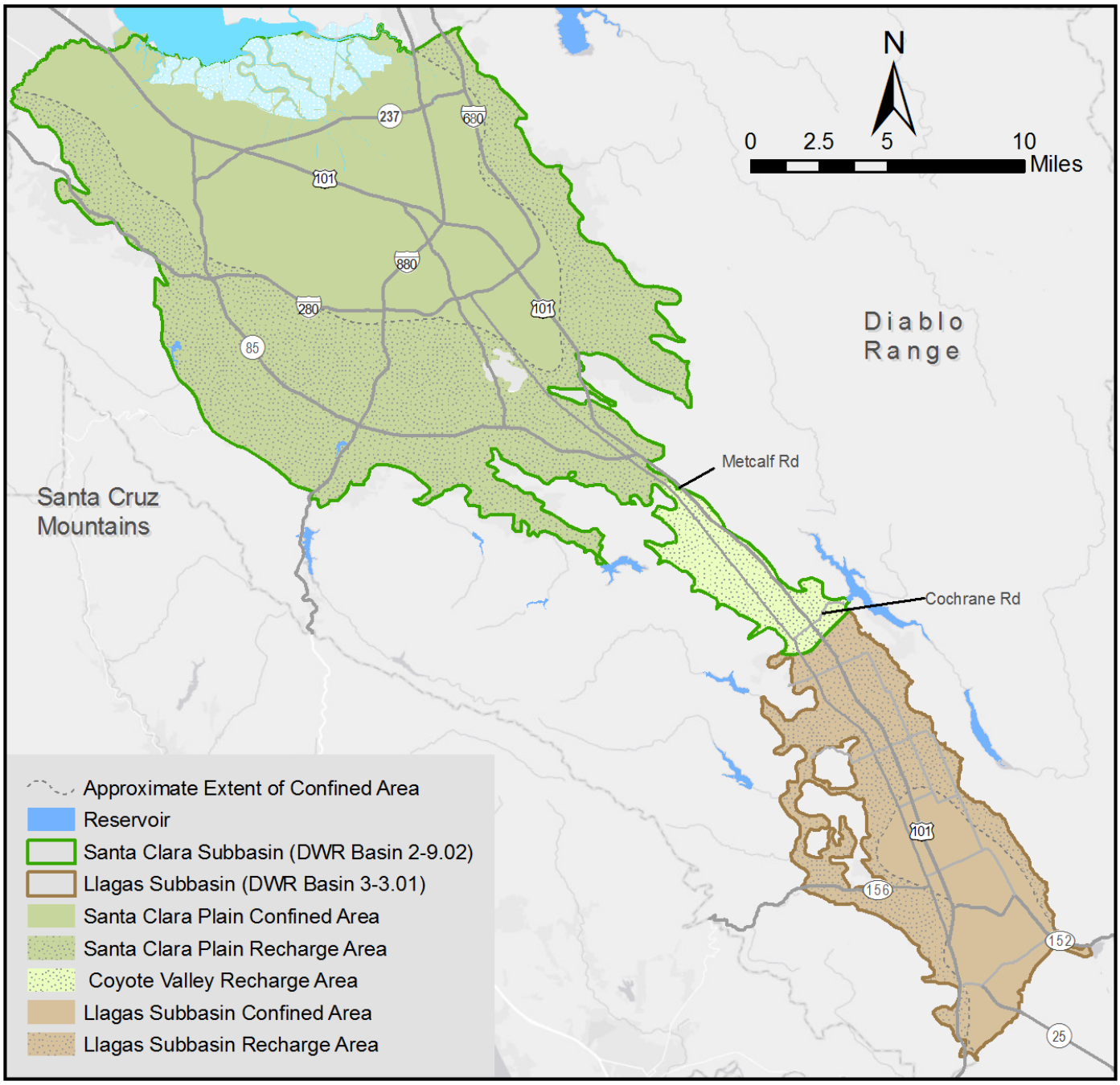
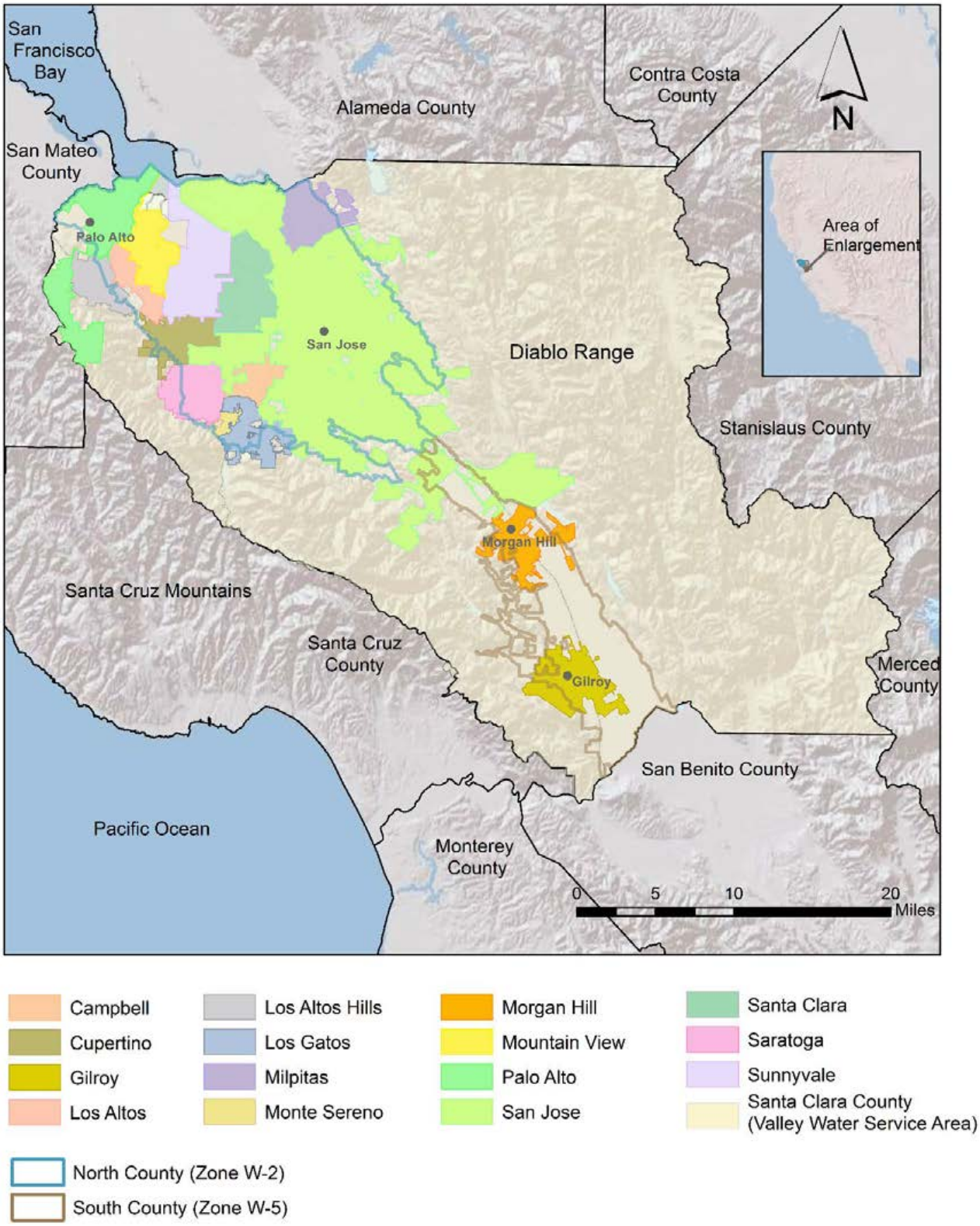


Figure 2. Groundwater Benefit Zones and Local Cities



CHAPTER 2 – GROUNDWATER PUMPING, RECHARGE, AND WATER BALANCE

Total groundwater pumping for 2019 in Zones W-2 and W-5 was 110,400 AF, providing 37% of the total water used[13] by county residents and businesses. Compared to 2018, groundwater pumping decreased 9% in the Santa Clara Plain, 8% in the Coyote Valley, and 3% in the Llagas Subbasin in 2019. Valley Water used about 83,500 AF of local and imported surface water to replenish the groundwater subbasins as managed recharge. In-lieu recharge, including treated and recycled water deliveries and water conservation programs, reduced demands on groundwater by approximately 195,000 AF.

Managed recharge provided about 57% of the total inflow to the subbasins and groundwater pumping accounted for over 84% of outflows. Due to good water supply conditions, the inflows exceeded the outflows, resulting in a net increase in countywide groundwater storage of 15,200 AF from 2018 to 2019.

2.1 Groundwater Pumping

Approximately 110,400 AF of groundwater was pumped in 2019, compared to 118,300 AF in 2018. Figures 3 and 4 show the locations and volumes of groundwater pumping and Table 1 summarizes the pumping by groundwater management area and use category.

Groundwater in North County is used primarily for Municipal and Industrial (M&I) purposes, with minimal agricultural or domestic use. In South County, agricultural use is more significant. This is especially evident in the Llagas Subbasin, where 56% of the use is for agriculture. While the quantity of groundwater used for domestic purposes is relatively small in South County, 74% of the 3,917 individual wells reporting using groundwater in South County were domestic wells (Table 2).

Table 1. CY 2019 Groundwater Pumping by Use (AF)

Use	Zone W-2 North County	Zone W-5 South County		Total
	Santa Clara Plain	Coyote Valley	Llagas Subbasin	
Municipal & Industrial (M&I)	57,000	8,000	16,700	81,700
Domestic	200	200	1,700	2,100
Agricultural	500	2,900	23,200	26,600
Total	**57,700**	**11,100**	**41,600**	**110,400**

Note: Large volume pumpers are metered and report groundwater production to Valley Water monthly. Pumping for wells reporting semi-annually or annually (primarily domestic and agricultural) was estimated based on available data and/or prior year data as validated data was not available by the date of publication of this report.

[13] Total water use in the county was 296,000 AF and it came from groundwater pumping (37.3%), Valley Water treated water deliveries (34.4%), San Francisco Public Utilities Commission supplies to local retailers (16.6%), recycled water deliveries (5.8%), raw surface water deliveries (0.3%), and San Jose Water Company and Stanford water rights (5.5%). This total does not reflect groundwater pumping in bedrock areas outside Zones W-2 and W-5; these areas are sparsely populated compared to the valley floor, with presumed low water use.

Table 2. Number of Wells Reporting Groundwater Use in CY 2019

Use	Zone W-2 North County	Zone W-5 South County		Total
	Santa Clara Plain	Coyote Valley	Llagas Subbasin	
Municipal & Industrial (M&I)	719	72	289	1,080
Domestic	310	347	2,534	3,191
Agricultural	42	95	580	717
Total	**1,071**	**514**	**3,403**	**4,988**

Note: Some wells may report pumping for more than one use category (e.g., domestic and agricultural). The number of wells reporting semi-annually or annually (primarily domestic and agricultural) was estimated based on prior year as validated data was not available by the date of publication of this report.

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Figure 3. CY 2019 Zone W-2 Groundwater Pumping

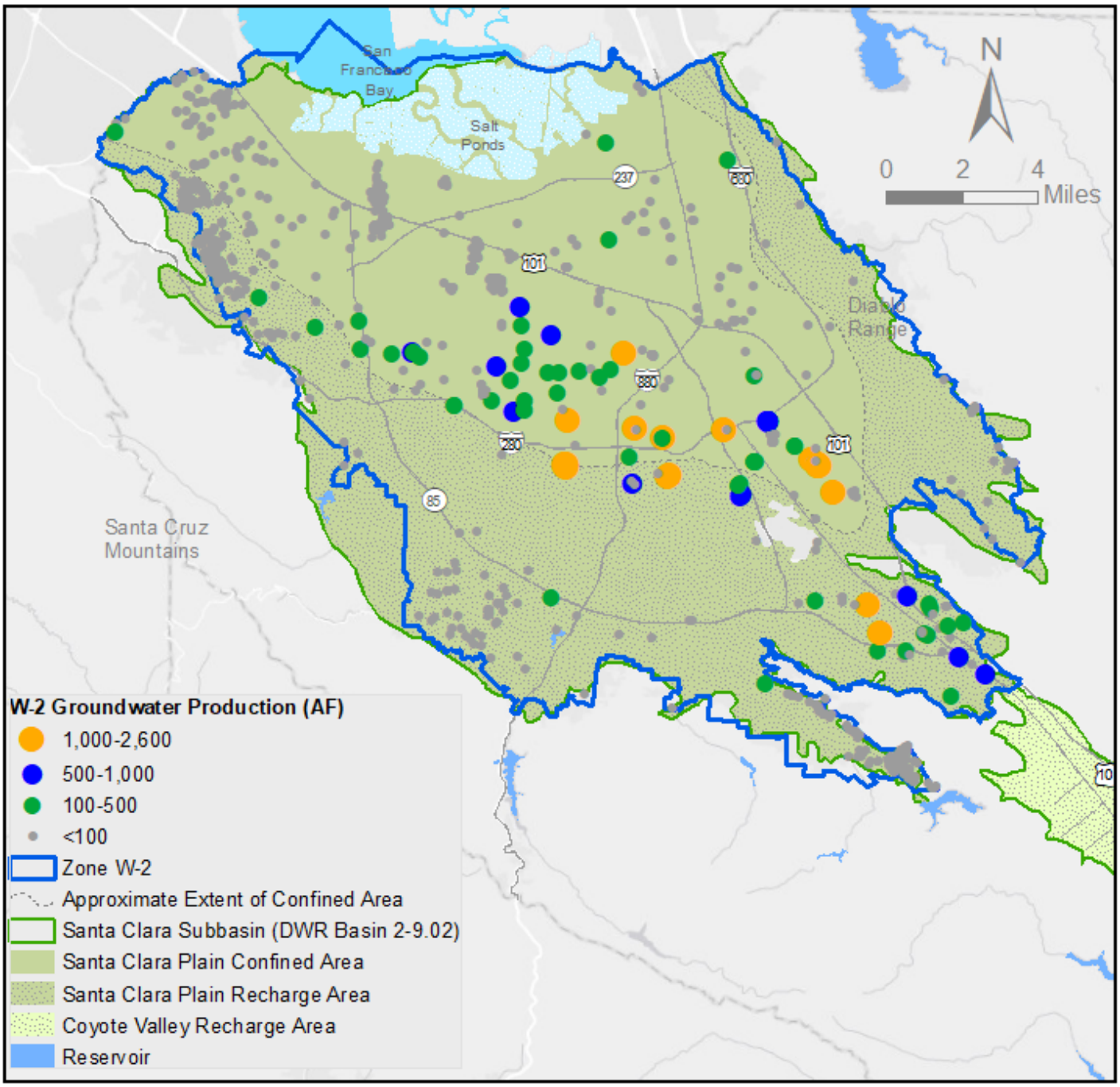
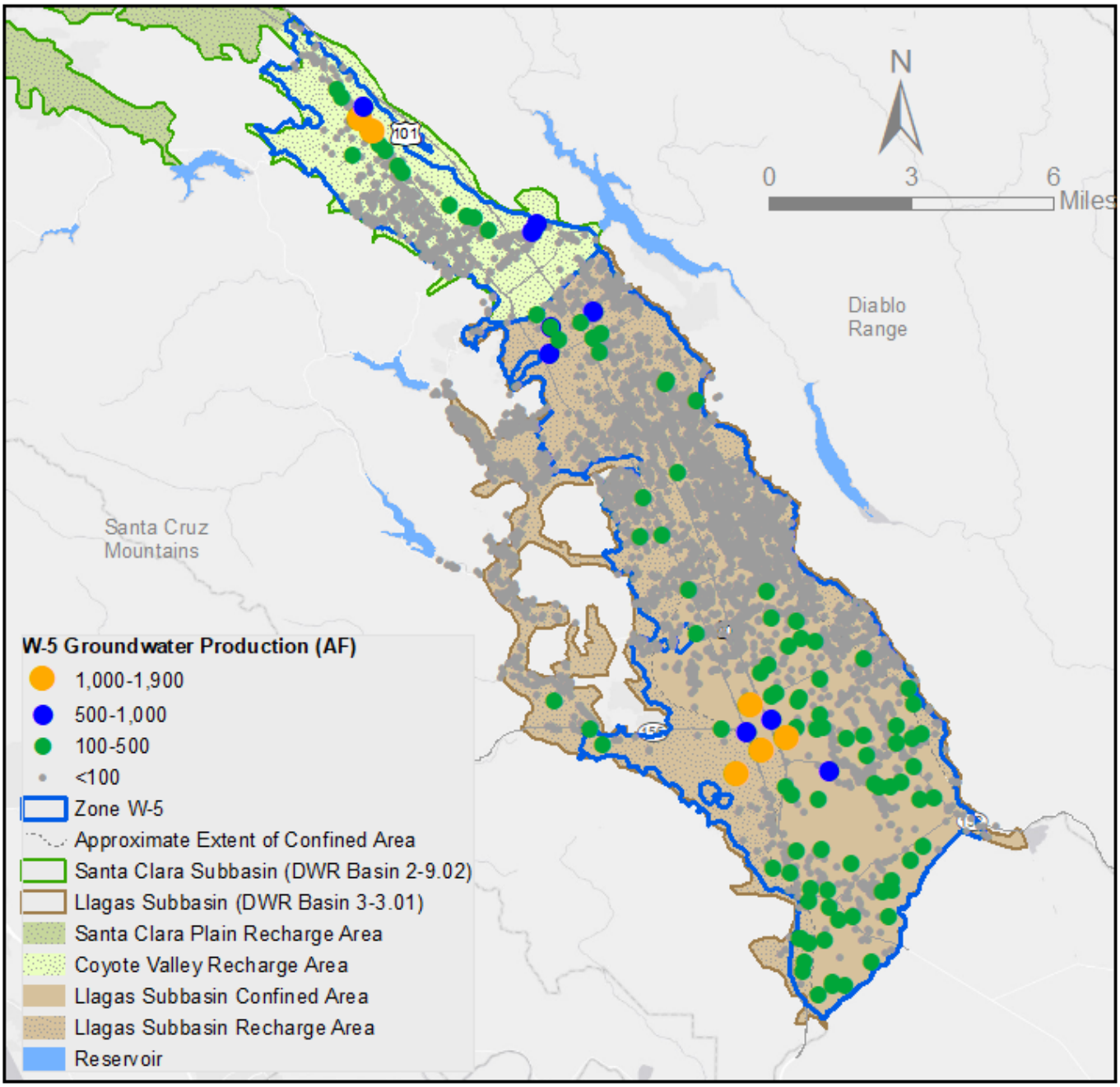


Figure 4. CY 2019 Zone W-5 Groundwater Pumping



Groundwater Pumping Trends

Countywide, estimated total water use was 296,000 AF in 2019, slightly less than 2018 (297,000 AF). Countywide groundwater pumping was down 7% from the previous year, below the recent five-year average, and below the average over the period of record. This is largely driven by low pumping in the Santa Clara Plain and Coyote Valley (Table 3). Compared to last year, groundwater pumping decreased 9% in the Santa Clara Plain, 8% in the Coyote Valley, and 3% in the Llagas Subbasin. Groundwater pumping is largely offset by Valley Water's managed recharge of local and imported surface water (Figure 5). Managed recharge typically averages about two thirds of the pumping, with natural recharge balancing the remaining pumping. Figure 6 shows the countywide water use by source, including groundwater, Valley Water treated water, San Francisco Public Utility Commission (SFPUC) supplies, local surface water, and recycled water. Groundwater provided 37% of the total water used countywide in 2019.

Groundwater pumping and use patterns over time are shown in Figure 7 for each of the groundwater management areas. In the Santa Clara Plain, pumping dropped significantly in the late 1980s following completion of Valley Water's Santa Teresa Water Treatment Plant (WTP). Since then, pumping has averaged 95,000 AF per year. Pumping spiked in the middle of the recent drought to 115,000 AF in 2014; however, the water retailers and community responded to the Valley Water Board's calls for water use reduction, and pumping decreased significantly during the past five years, averaging about 62,500 AF per year. A notable increase in pumping in the Coyote Valley occurred in 2006 when a water retailer installed new wells and began extracting water to serve customers in the Santa Clara Plain. This increased the average annual pumping volume by about 4,000 AF in Coyote Valley as reflected in Table 3. Pumping in the Llagas Subbasin has remained relatively stable over the period of record.

Table 3. CY 2019 Groundwater Pumping Compared to Other Periods (AF)

Period	Zone W-2 North County	Zone W-5 South County		Total
	Santa Clara Plain	Coyote Valley	Llagas Subbasin	
2019	57,700	11,100	41,600	110,400
2018	63,400	12,000	42,900	118,300
5 Year Average (2015-2019)	62,500	11,200	41,400	115,100
Period of Record (Average)	106,500	7,400	40,500	154,400

Note: The period of record is 1981-2019 for the Santa Clara Plain and 1988-2019 for the Coyote Valley and Llagas Subbasin.

Major Groundwater Users

The largest groundwater users in each zone are shown in Figure 8. Water retailers are the primary users in North County, accounting for over 89% of all pumping in 2019. San Jose Water Company is the largest individual user, accounting for 57% of total North County pumping, followed by other retailers and a few large industrial users. Unlike North County, 53% of pumping in South County was from thousands of individual pumpers including agricultural and domestic users. In South County, pumping by water retailers and water companies accounted for 39% of groundwater use. Other large users include golf courses and industrial facilities.

Figure 5. Countywide Groundwater Pumping and Managed Recharge

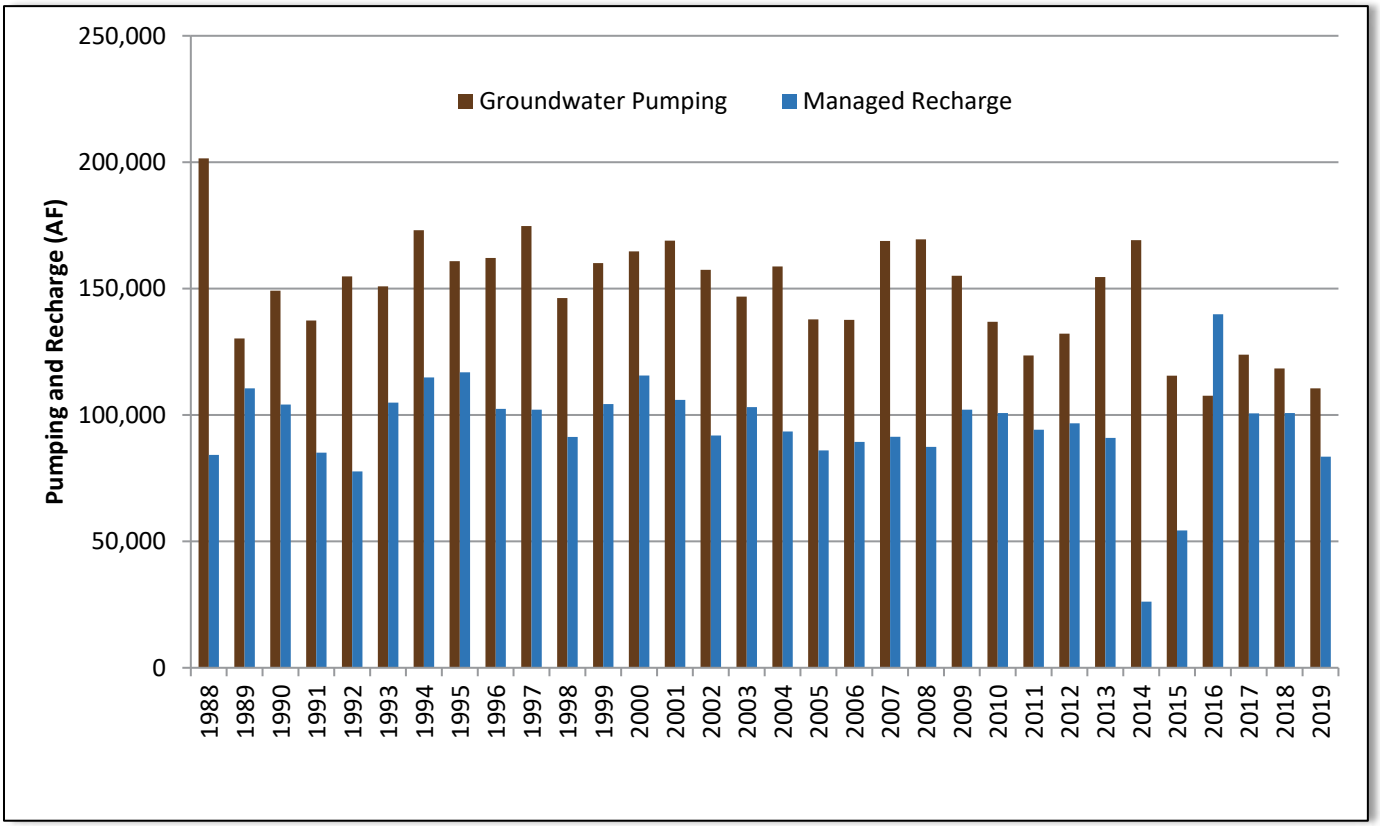


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Figure 6. Countywide Water Use

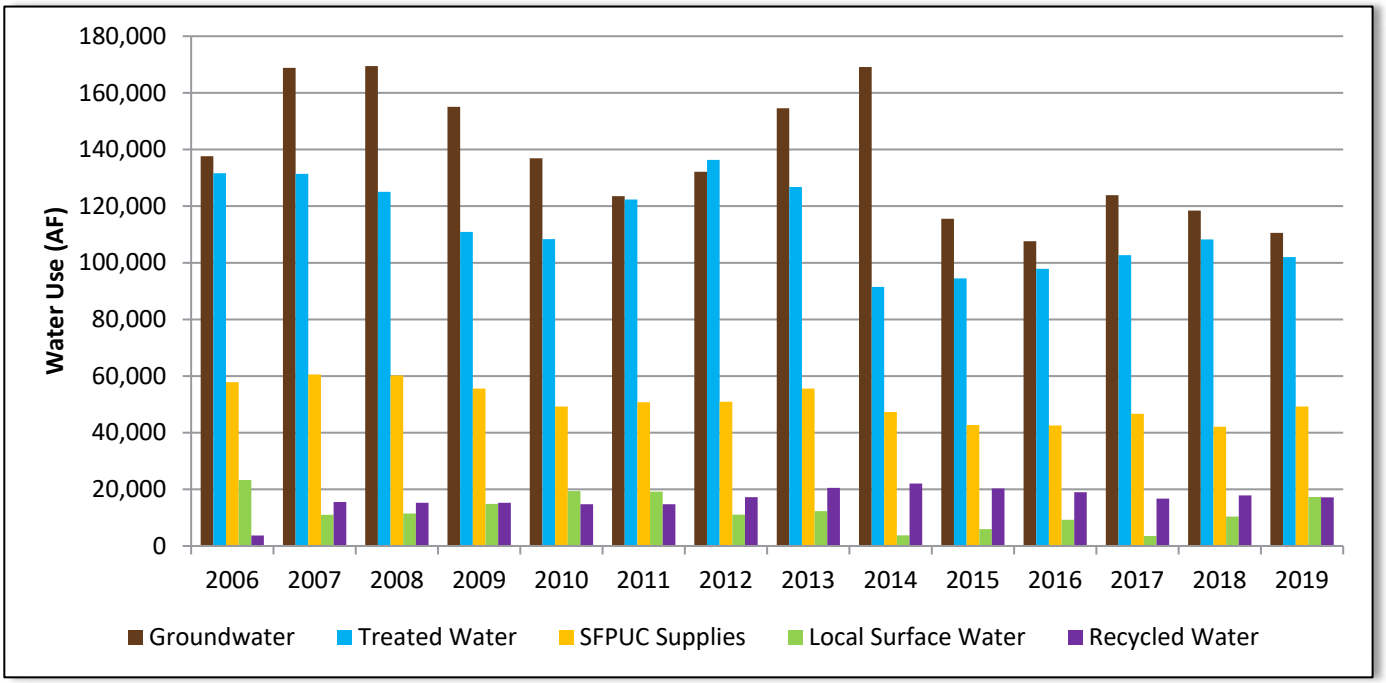

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Figure 7. Groundwater Pumping by Use Category

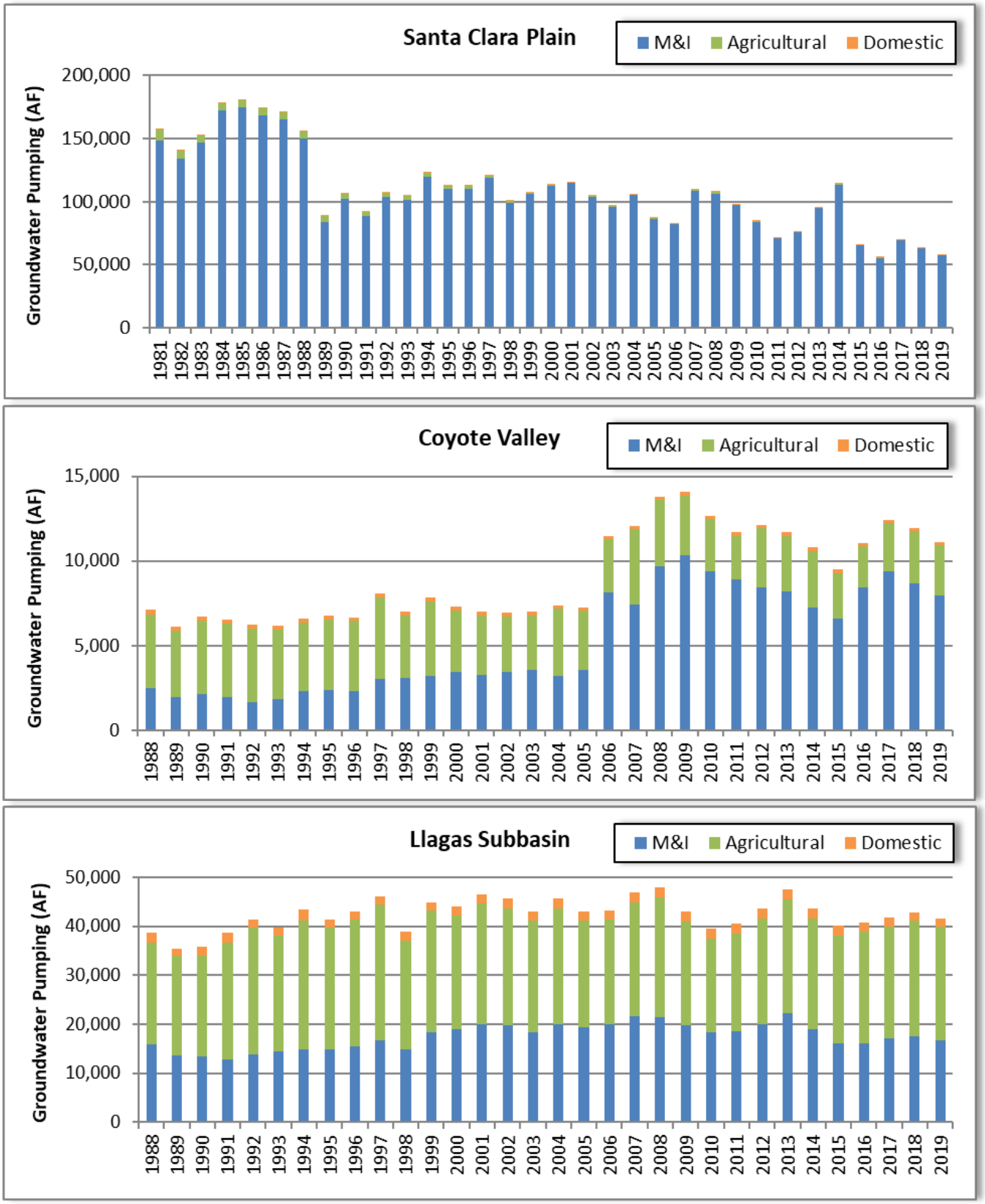
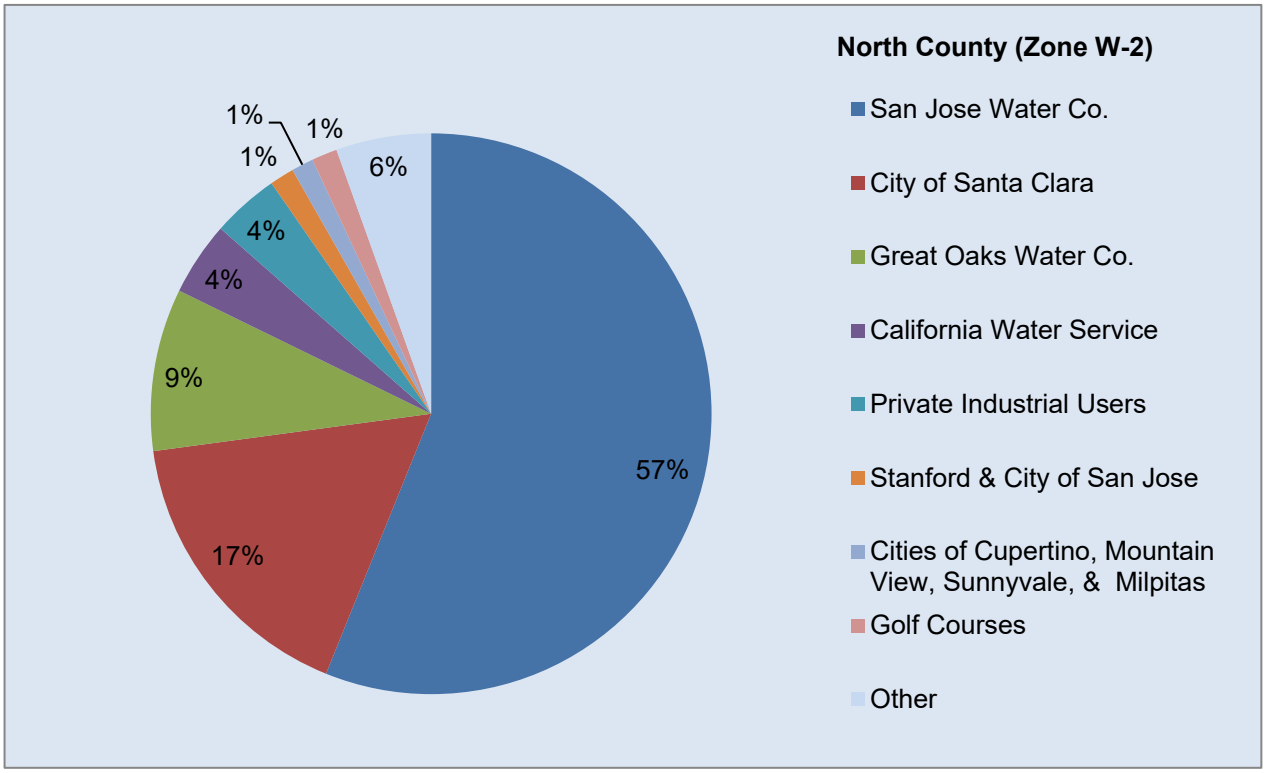
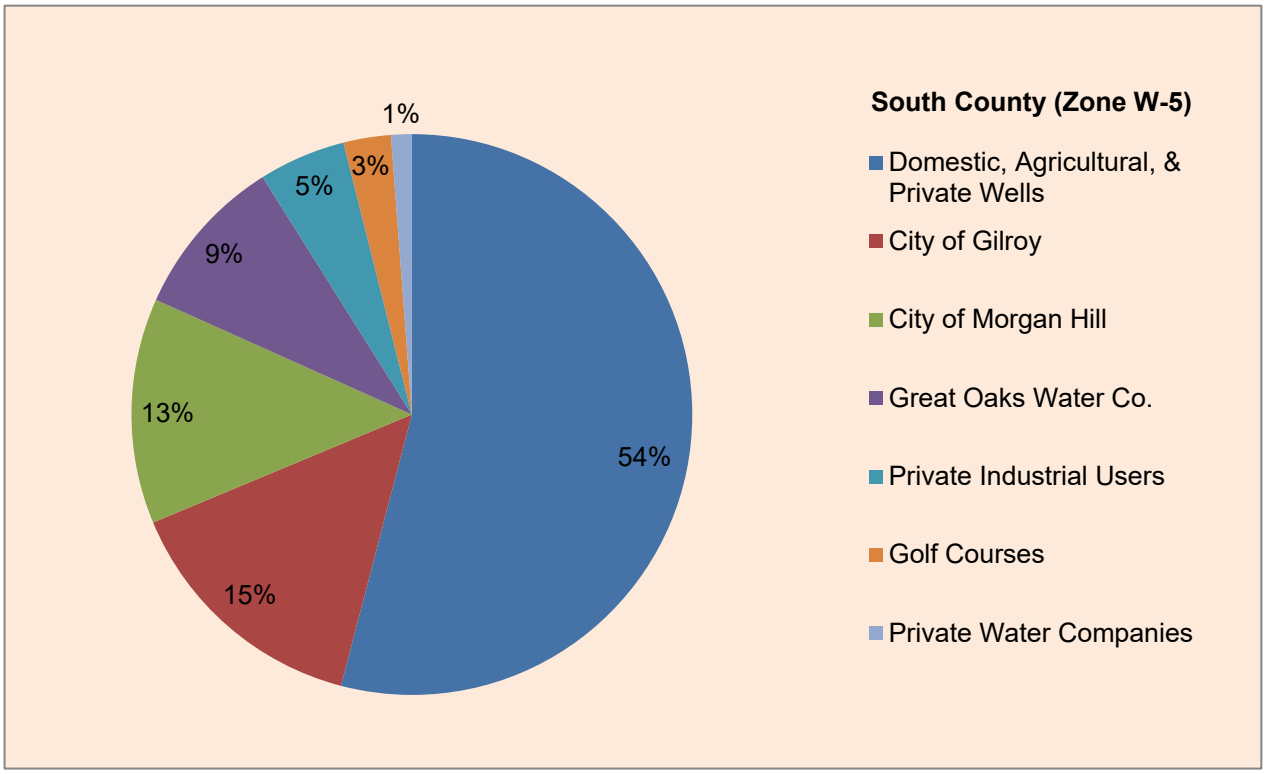


Figure 8. Percent of Total Pumping by Major Groundwater Users in 2019

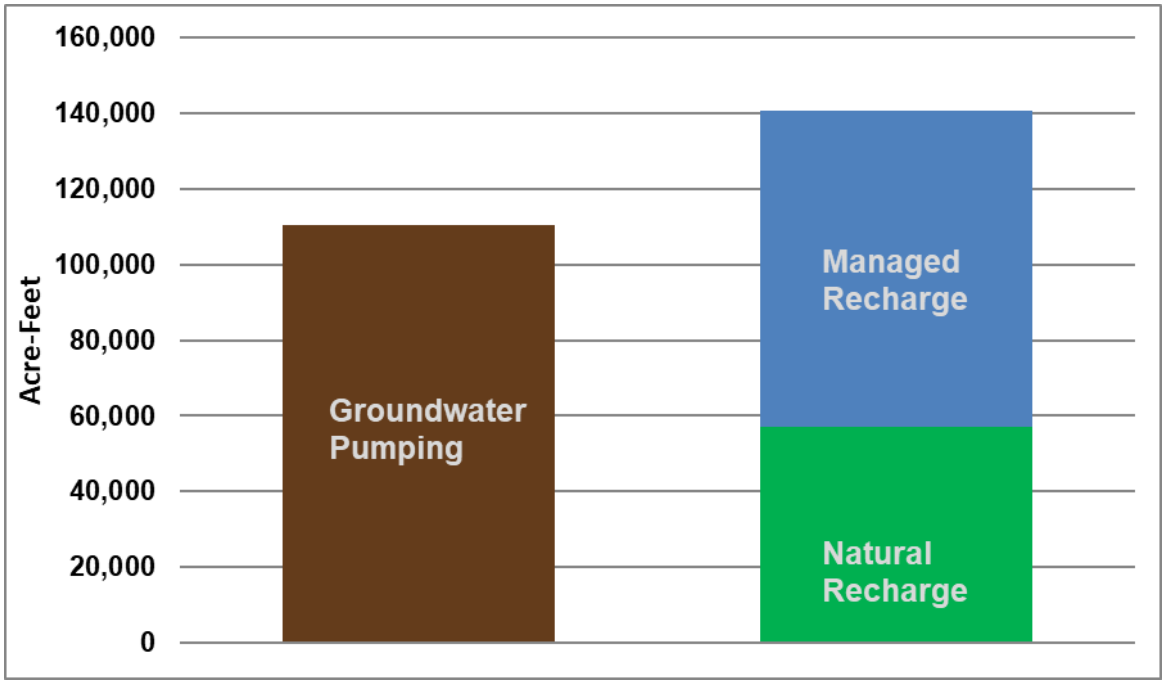




2.2 Groundwater Recharge

Since the 1930s, Valley Water's water supply strategy has been to maximize the conjunctive management of surface water and groundwater. Annual groundwater pumping far exceeds what is replenished naturally, so Valley Water ensures water supply reliability with its managed recharge and in-lieu recharge activities. Total recharge exceeded groundwater pumping in 2019 (Figure 9) by a larger than normal margin due to below average pumping, above average rainfall, and the availability of surface water to fully operate the managed recharge program.

Figure 9. Countywide Groundwater Pumping and Recharge in CY 2019



Managed Recharge

Valley Water replenishes groundwater with imported water and surface runoff captured in 10 local reservoirs. Recharge facilities include more than 300 acres of recharge ponds and over 90 miles of creeks (Figure 10). Imported sources include the Federal Central Valley Project (CVP) and the State Water Project (SWP). The relative amounts of imported or local water used for managed recharge each year depend on many factors including hydrology, imported water allocations, treatment plant demands, and environmental needs. In general, a greater percentage of local water is used for recharge in wet years due to increased capture of local storm runoff in local reservoirs. Valley Water recharged 83,500 AF of local and imported surface water in 2019 (Table 4), below the long-term average of 95,000 AF. In North County, Valley Water operated a reduced managed recharge program, leaving many percolations ponds dry due to healthy groundwater conditions (including very strong artesian pressures near the bay) and continued low pumping. Countywide, most of the managed recharge (80%) occurred in-stream, with the remainder through percolation ponds. Most water used for managed recharge came from local sources (82% in North County and 74% in South County). Overall, imported water contributed 22% to total managed recharge in CY 2019, as shown in Figure 11.

Table 4. CY 2019 Managed Recharge (AF)

Zone	In-Stream Recharge (Creeks)	Off-Stream Recharge (Recharge Ponds)	Total
W-2 (North County)	29,600	12,400	42,000
W-5 (South County)	36,900	4,600	41,500
Total	66,500	17,000	83,500

Figure 10. Valley Water Managed Recharge Facilities

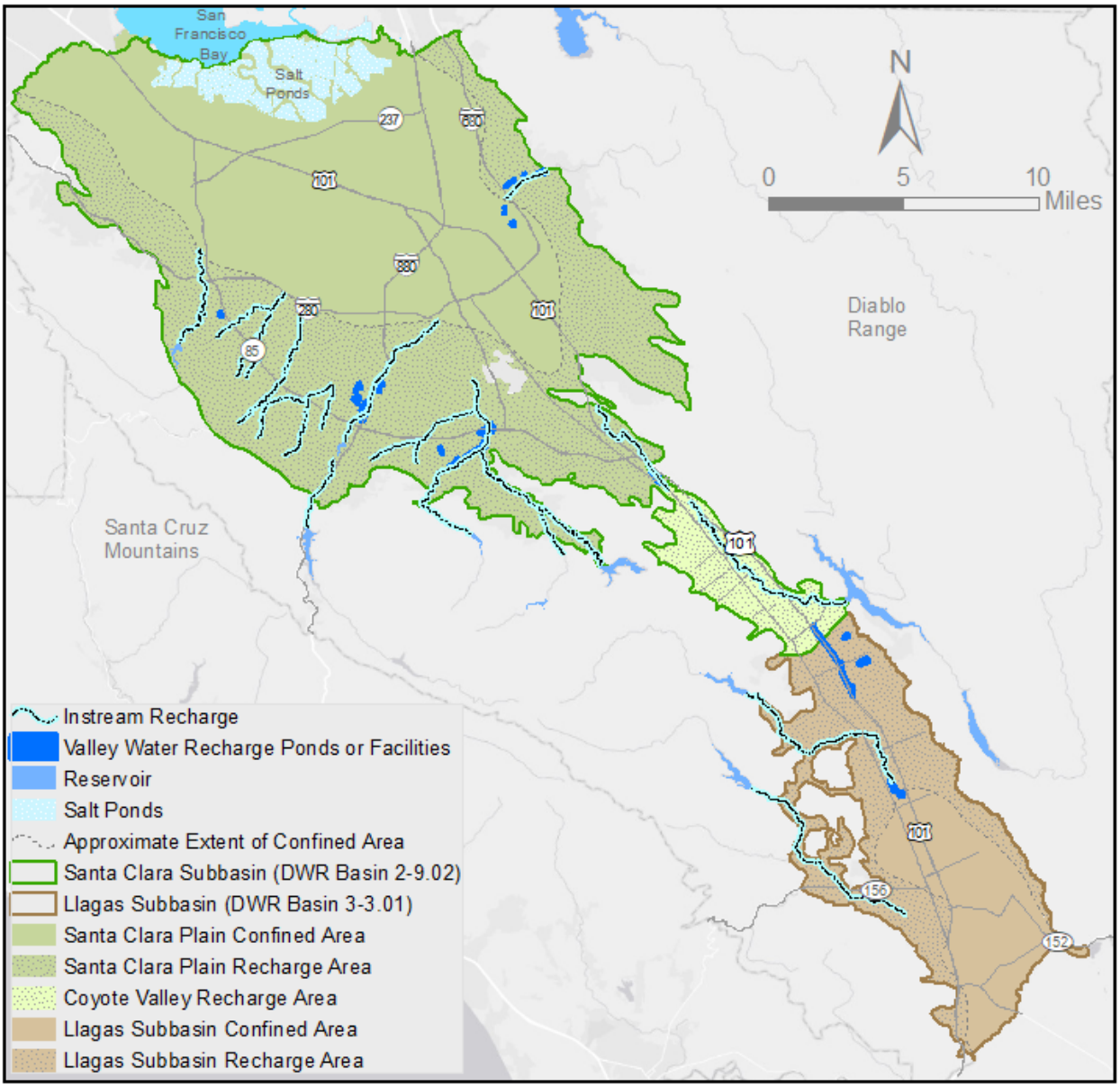
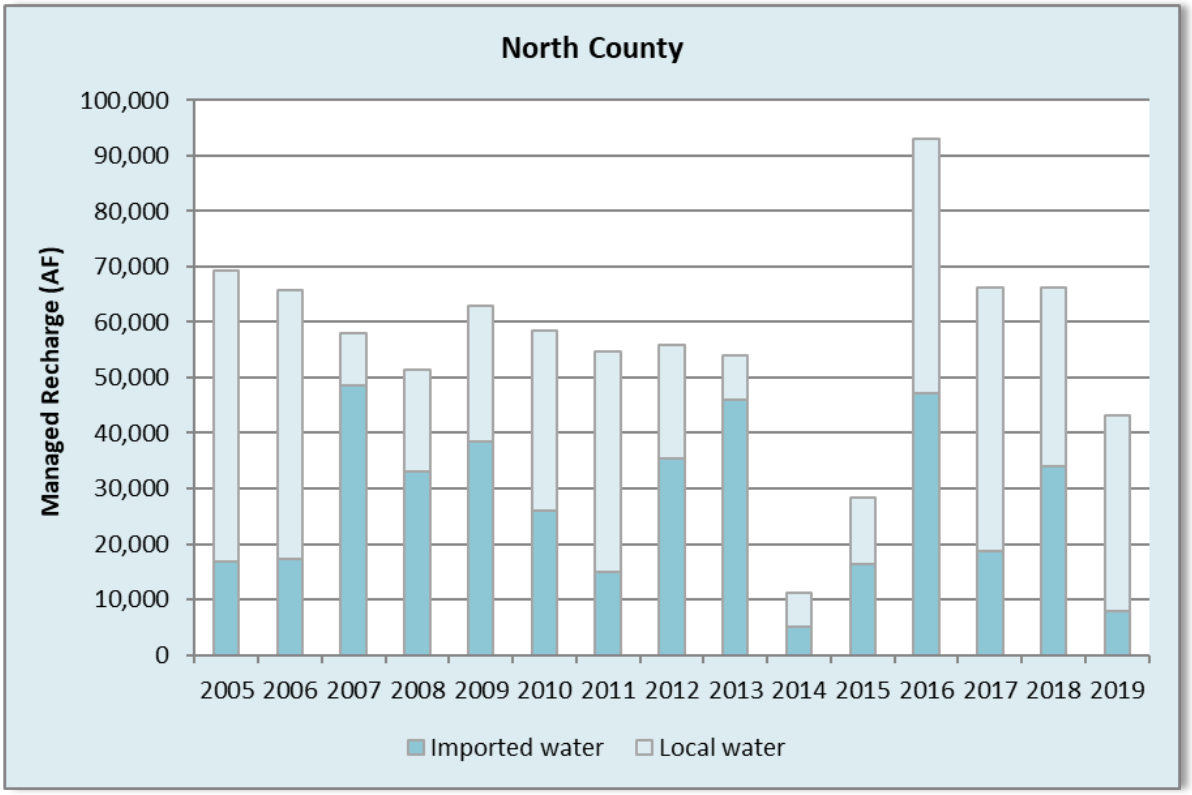
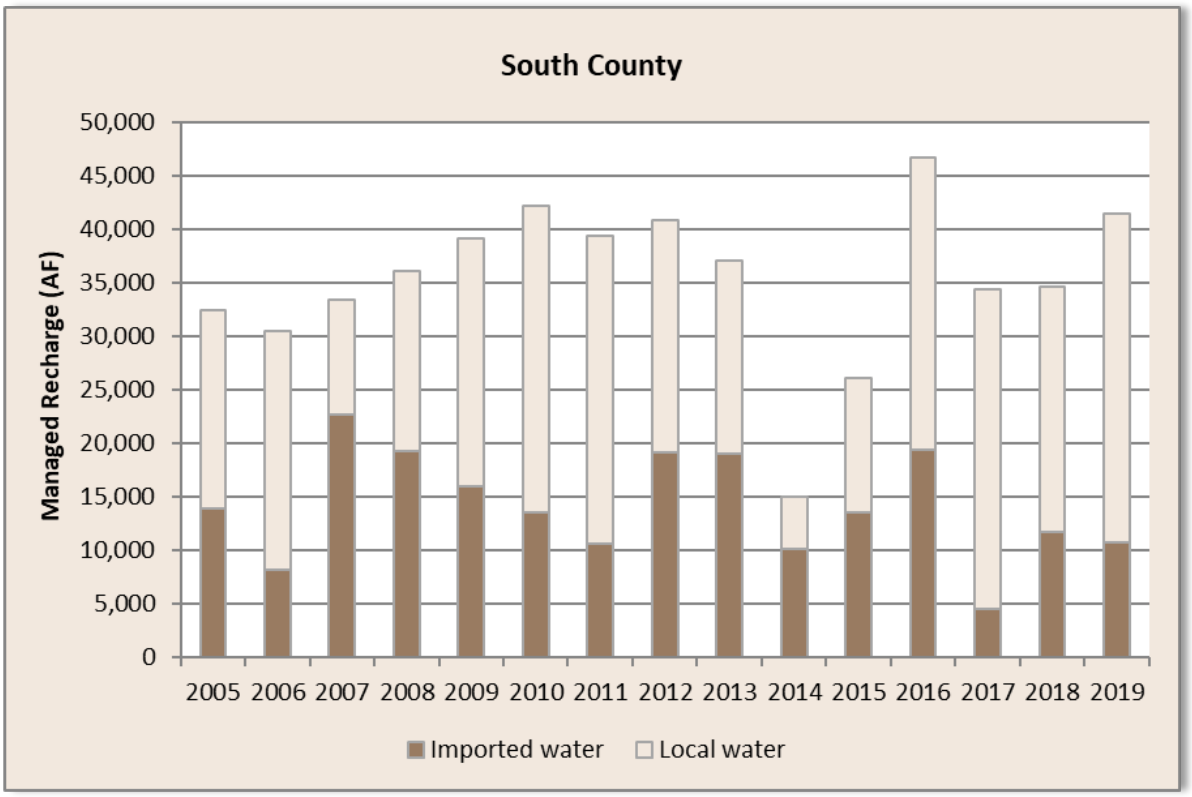


Figure 11. Managed Recharge by Source - North County and South County





Valley Water's 10 reservoirs were constructed in the 1930s and 1950s. Operating restrictions have been imposed on five of the reservoirs while seismic stability concerns are mitigated. These dam safety operating restrictions reduce the amount of water that can be stored for groundwater recharge by 55,000 AF but are needed to provide an adequate level of public safety. The restrictions result in a loss of about one third of the total surface storage capacity of Valley Water reservoirs. Current or upcoming Valley Water facility projects include seismic upgrades of Anderson, Calero, and Guadalupe dams, rehabilitation of Almaden Dam outlet works, replacement of Almaden Dam spillway, and rehabilitation of the Almaden-Calero Canal. The first phase of the seismic investigations of Coyote, Chesbro, and Uvas dams was concluded in 2019. The design of the Anderson Dam Seismic Retrofit Project (ADSRP) has progressed in 2019.

Recently, the Federal Energy Regulatory Committee (FERC) demanded that Valley Water begin draining Anderson Reservoir on October 1, 2020 down to deadpool. Draining the largest reservoir in the county is needed prior to removing the existing dam embankment and reconstructing the dam from the core up. To comply with the FERC order, Valley Water developed a Dewatering Plan and initiated another project, the FERC Order Compliance Project (FOCP). The FOCP proposes a set of interim risk reduction measures to protect the public from the risk of dam failure due to seismic activity and also a set of avoidance and minimization measures for the time period prior to construction and operation of the ADSRP to reduce the public safety, health, water supply, and environmental impacts of draining Anderson Reservoir. The FOCP consists of multiple components, three of which are heavy construction projects – a new Anderson Dam Tunnel with a low-level outlet pipe that can carry 2,000 cubic feet per second (cfs), an extension of the Cross Valley Pipeline to Coyote Creek downstream of Ogier Ponds, and a replacement of the Coyote Percolation Pond flashboard dam with an inflatable bladder dam. Valley Water's top priority is to complete the FOCP in 2023 and then complete the ADSRP by 2030.

In-Lieu Recharge

Valley Water's treated water deliveries, water conservation, and recycled water programs play a critical role in maintaining groundwater storage by reducing the demand on groundwater. In 2019, treated water and recycled water provided 102,000 and 17,000 AF, respectively. Valley Water's long-term water conservation programs also saved approximately 76,000 AF.[14]

Valley Water's Silicon Valley Advanced Water Purification Center began operating in 2014. This state-of-the-art facility in San Jose produces up to 8 million gallons per day, or 9,000 AF per year, of highly purified water by treating recycled water with microfiltration, reverse osmosis, and ultraviolet light. This purified water is then blended with tertiary-treated recycled water to improve the quality for landscape irrigation and industrial uses. This facility supports Valley Water's goal of expanding the use of recycled and purified water, which reduces the demand on groundwater and increases supply reliability.

2.3 Groundwater Balance

While groundwater storage may increase or decrease each year, Valley Water's comprehensive managed and in-lieu recharge programs ensure long-term balance. The annual groundwater balance presented evaluates annual inflows and outflows for the Santa Clara Plain, Coyote Valley, and Llagas Subbasin, as shown in Figure 12. It should be noted that some terms presented in the groundwater balance cannot be directly measured and represent estimated values from Valley Water's calibrated groundwater flow models.

[14] Santa Clara Valley Water District, Protection and Augmentation of Water Supplies, FY 2020-21 (PAWS), 49th Annual Report, February 2020.

Inflows

Major inflows to the subbasins are primarily controlled by hydrologic conditions that include:

- Managed recharge by Valley Water, using local and imported surface water; and
- Natural recharge, which includes deep percolation of rainfall, natural seepage through creeks, subsurface inflow from adjacent aquifers, water loss from transmission and distribution lines, mountain front recharge, and return flows from septic systems and irrigation

Valley Water quantifies managed recharge using streamflow measurements and measured releases from reservoirs and raw water pipelines. Rainfall is measured at precipitation gage stations in San Jose (NOAA[15] Station USW00023293), Los Gatos (NOAA Station USC00045123), Coyote Valley (Valley Water Station 37), and Morgan Hill (Valley Water Station 41). These stations provide rainfall data used in each of Valley Water's three calibrated numerical groundwater flow models (MODFLOW) for the Santa Clara Plain, Coyote Valley, and Llagas Subbasin. Subsurface inflows and outflows to and from adjacent aquifer systems and mountain front recharge are derived from Valley Water's calibrated groundwater flow models. Total inflows to all subbasins was 146,900 AF in 2019, with managed recharge providing 57% of total inflows (Figure 12).

Both locally and statewide, precipitation 2019 was above normal, and included several storm events characterized as "atmospheric rivers" that resulted in significant rainfall and surface water runoff. However, large storm events in a relatively short period of time do not typically provide a large amount of natural groundwater recharge due to high runoff and limited time for percolation. Estimated natural recharge in 2019 was 57,100 AF, approximately 133% higher than in 2018.

Outflows

The primary outflow of groundwater is pumping, which accounted for 84% of the total outflow of 131,700 AF in 2019. Most groundwater pumped is metered. In Zone W-2, meters are required for wells pumping more than 1 AFY of non-agricultural water or 4 AFY of agricultural water annually. In Zone W-5, meters are required for wells producing more than 2 AFY of non-agricultural water or 20 AFY of agricultural water. Where meters are not installed, crop factors are used to determine agricultural water use, whereas domestic use is estimated from a table of average uses. Subsurface outflow to adjacent aquifer systems, creeks, storm and sewer systems, and plant uptake was 21,300 AF, or 16% of the total outflow.

Change in Storage

There was an estimated increase in countywide storage of 15,200 AF in 2019 because the groundwater inflows exceeded the outflows. Compared to 2018, storage in the Santa Clara Plain, the Coyote Valley and Llagas Subbasin increased by 6,300 AF, 2,000 AF and 6,900 AF, respectively (Figure 12). This resulted in a total estimated storage of 356,700 AF. This is well within the "Normal" stage of Valley Water's Water Shortage Contingency Plan, which represents storage above 300,000 AF. Groundwater levels and storage are described in more detail in Chapter 3.

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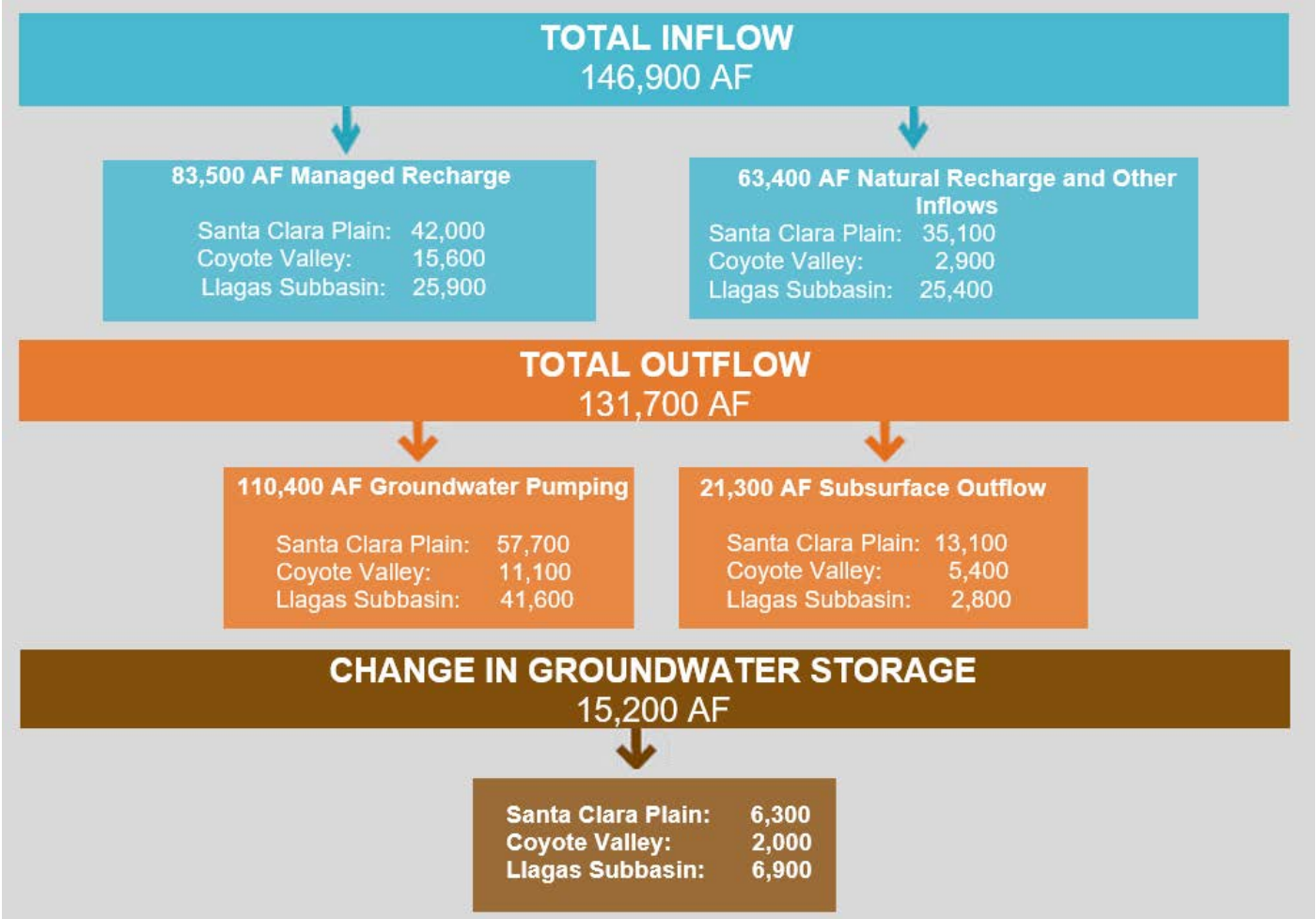
[15] U.S. Department of Commerce National Oceanic and Atmospheric Administration (NOAA).

Figure 12. CY 2019 Groundwater Balance



Notes:

1. Groundwater balance terms presented are estimates as of March 2020. These estimates are refined as additional data becomes available. Values shown are based on measured quantities or calibrated groundwater flow models, with all values rounded to the nearest 100 AF.
2. Managed recharge represents direct replenishment by Valley Water using local and imported water. Estimates from the groundwater models may differ slightly from surface water accounting estimates.
3. Natural recharge and other inflows include the deep percolation of rainfall, septic system and/or irrigation return flows, natural seepage through creeks, storm and sewer system seepage, and inflow from adjacent aquifer systems.
4. The groundwater pumping estimate is based on pumping metered by Valley Water or reported by low-volume groundwater users.
5. Subsurface outflow represents outflow to adjacent aquifer systems. In the Santa Clara Plain, this includes outflows to San Francisco Bay; in the Coyote Valley, this includes outflow to the Santa Clara Plain; and in the Llagas Subbasin, this includes outflows to the North San Benito Subbasin in San Benito County.

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CHAPTER 3 – GROUNDWATER LEVELS AND STORAGE

Valley Water measured groundwater levels in 237 wells in 2019 and obtained water levels from an additional 112 wells measured by water retailers. After rising to pre-drought levels in 2017, groundwater levels throughout the county remained high in 2019 due to good water supply conditions and continued water use reductions. Groundwater reserves increased by an estimated 15,200 AF during 2019 because total recharge exceeded pumping and other outflows. The estimated end of 2019 groundwater storage was 356,700 AF, which is in the normal stage of Valley Water's Water Shortage Contingency Plan and is well above the Groundwater Management Plan (GWMP) storage target of 300,000 AF. Also, the projected end of year storage for 2020 is expected to be well above the 300,000 AF target.

3.1 Groundwater Levels

Comprehensive and accurate groundwater level data allows Valley Water to evaluate storage conditions and supports good operational decisions and water supply planning. In 2019, Valley Water measured depth to water at 237 wells on a daily to monthly basis and obtained similar data from 112 water retailer wells (Figure 13). As the designated monitoring entity for Santa Clara County under the California Statewide Groundwater Elevation Monitoring (CASGEM) program, Valley Water uploaded over 1,200 groundwater elevation measurements for 129 wells to the CASGEM website in 2019.

Three groundwater level index wells are used to represent broad regional conditions in the Santa Clara Plain, Coyote Valley, and Llagas Subbasin (Figures 13 and 14). Table 5 shows March and October 2019 groundwater elevations for these index wells; these months typically represent the seasonal high and low groundwater elevations, respectively. The 2019 average groundwater elevation was 1.9 feet lower than the previous year in the Santa Clara Plain, 4.5 feet higher in the Coyote Valley, and 5.4 feet higher in the Llagas Subbasin. Groundwater elevations remained well above the historical minima and above levels during the drought of 1987-1992 (Figure 14). Groundwater elevations were also well above the thresholds established to minimize the risk of land subsidence in all subsidence index wells throughout 2019.[16] All available groundwater elevation and depth-to-water data can be accessed on Valley Water's website at valleywater.org/groundwater.

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[16] To avoid resumption of permanent subsidence, Valley Water has established subsidence thresholds at ten index wells in the Santa Clara Plain as described further in Chapter 4.

Table 5. Groundwater Elevations at Regional Index Wells (feet, NGVD88)

Groundwater Subbasin/Area	Index Well	March 2019	October 2019	2019 Average	2018 Average	5 Year Average (2015-2019)	Period of Record Average
Santa Clara Subbasin, Santa Clara Plain	07S01W25L001	95.4	86.2	90.7	92.6	77.5	16.9
Santa Clara Subbasin, Coyote Valley	09S02E02J002	285.2	272.3	277.2	272.6	271.8	267.1
Llagas Subbasin	10S03E13D003/ 10S03E13E007	239.9	222.3	229.0	223.6	216.1	220.7

Note: The period of record for the index wells is 1936-2019 for the Santa Clara Plain, 1948-2019 for the Coyote Valley, and 1969-3/2019 from 10S03E13D003 and 11/2019-current from 10S03E13E007 for the Llagas Subbasin. The Llagas Subbasin well was replaced in November so there was no measurement for Llagas Subbasin in October 2019; the value shown is for November 2019.

Groundwater elevation contours for the principal aquifer zone in spring and fall of 2019 are shown in Figures 15 and 16. The spring and fall maps were created using the water level measurements closest to March 31, 2019 and September 30, 2019, respectively. The typical seasonal pattern observed is that groundwater levels peak in the spring and decline through the summer and fall due to increased pumping and less natural recharge; groundwater levels then usually start rising with the late fall and winter rains. While this pattern is apparent in Figures 15 and 16, the recent seasonal changes are not as pronounced as in some past years due to reduced pumping by major retailers.

In the Santa Clara Subbasin, the general groundwater flow direction is northwest from the Coyote Valley toward San Francisco Bay. Valley Water's managed recharge program helps maintain adequate pressures in the principal aquifer zone such that groundwater flows toward the bay and maintains an upward vertical gradient near the bay. The upward gradient minimizes the potential for saltwater intrusion into the principal aquifers. Artesian conditions occur in the confined area of the Santa Clara Plain and, in 2019, an increasing number of wells had groundwater with substantial artesian pressure.

The 2019 groundwater flow patterns observed in South County were similar to those observed in the past. In Coyote Valley, the highest elevations are at the divide between the Santa Clara Subbasin and the Llagas Subbasin near Cochrane Road and groundwater generally flows toward the northwest. The highest groundwater elevations in the Llagas Subbasin are in the recharge area in Morgan Hill, and groundwater generally flows southeast toward the Pajaro River and San Benito County. Managed and natural recharge within the recharge area maintains groundwater pressures within the southern confined area, where deeper groundwater occurs in partially to fully confined (artesian) conditions. Similar to the Santa Clara Plain, artesian pressures in the Llagas Subbasin increased in some wells in 2019.

Figure 13. CY 2019 Groundwater Level Monitoring

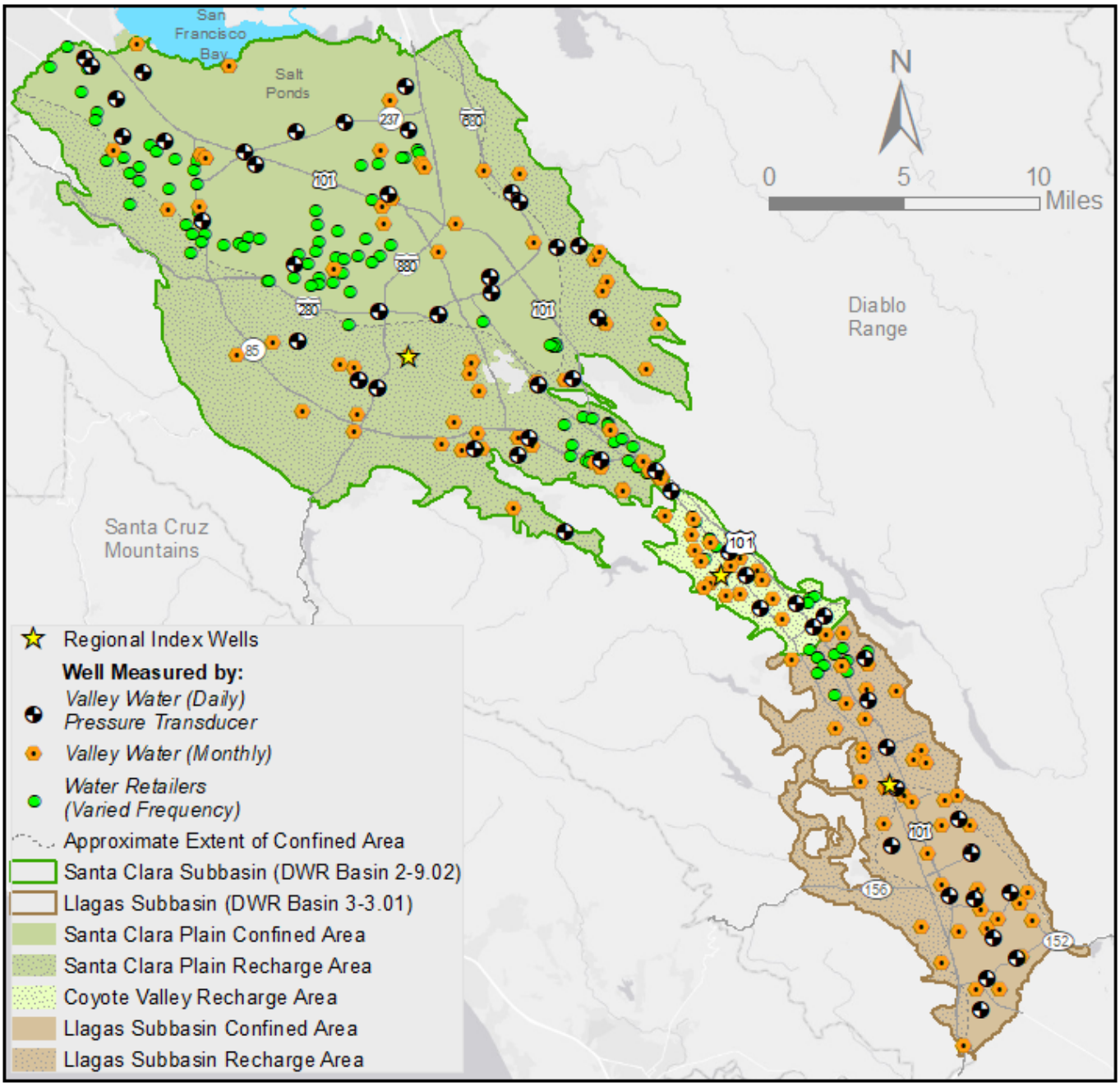


Figure 14. Groundwater Elevations at Regional Index Wells

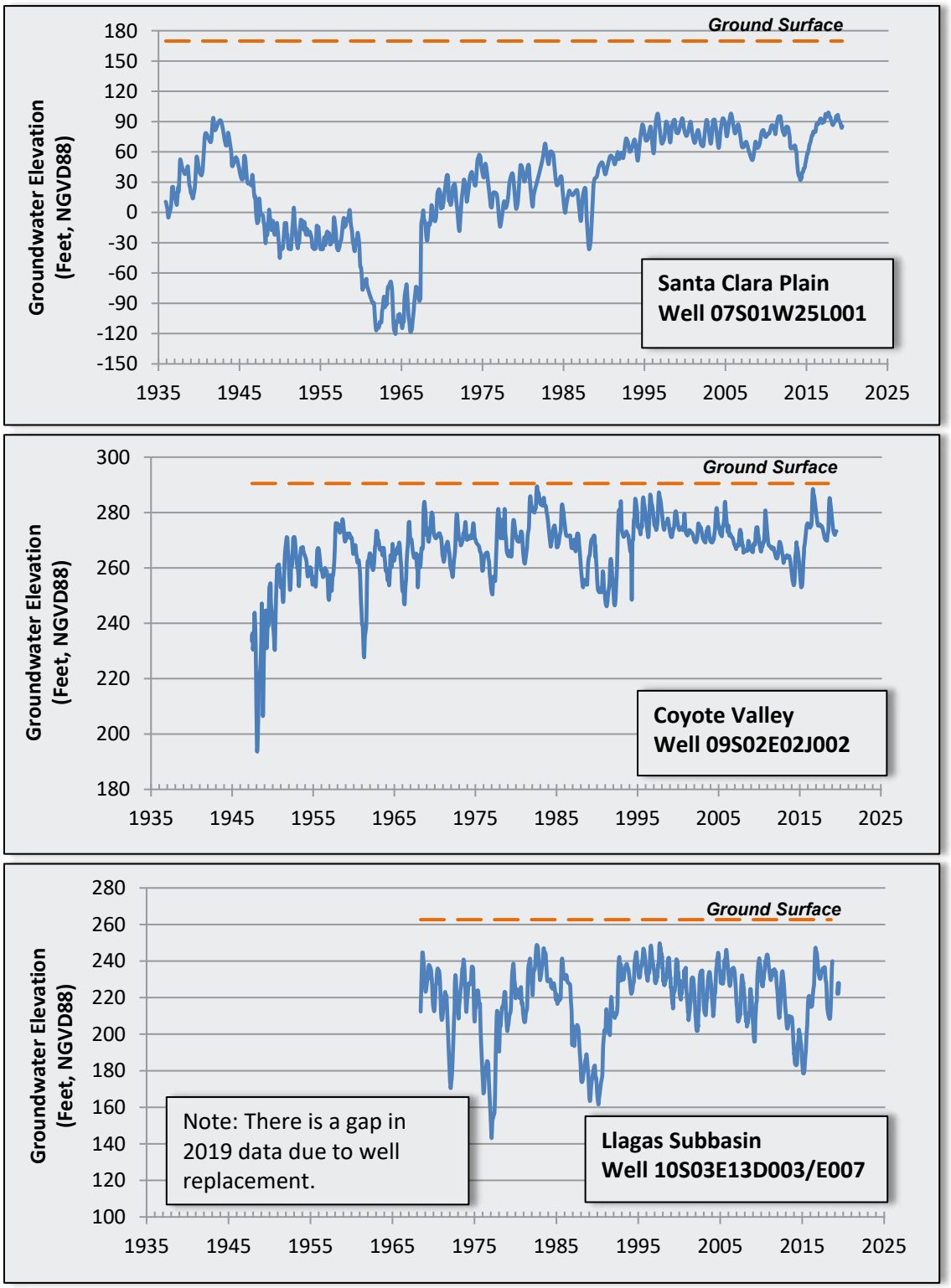


Figure 15. Spring 2019 Groundwater Elevation Contours in the Principal Aquifers

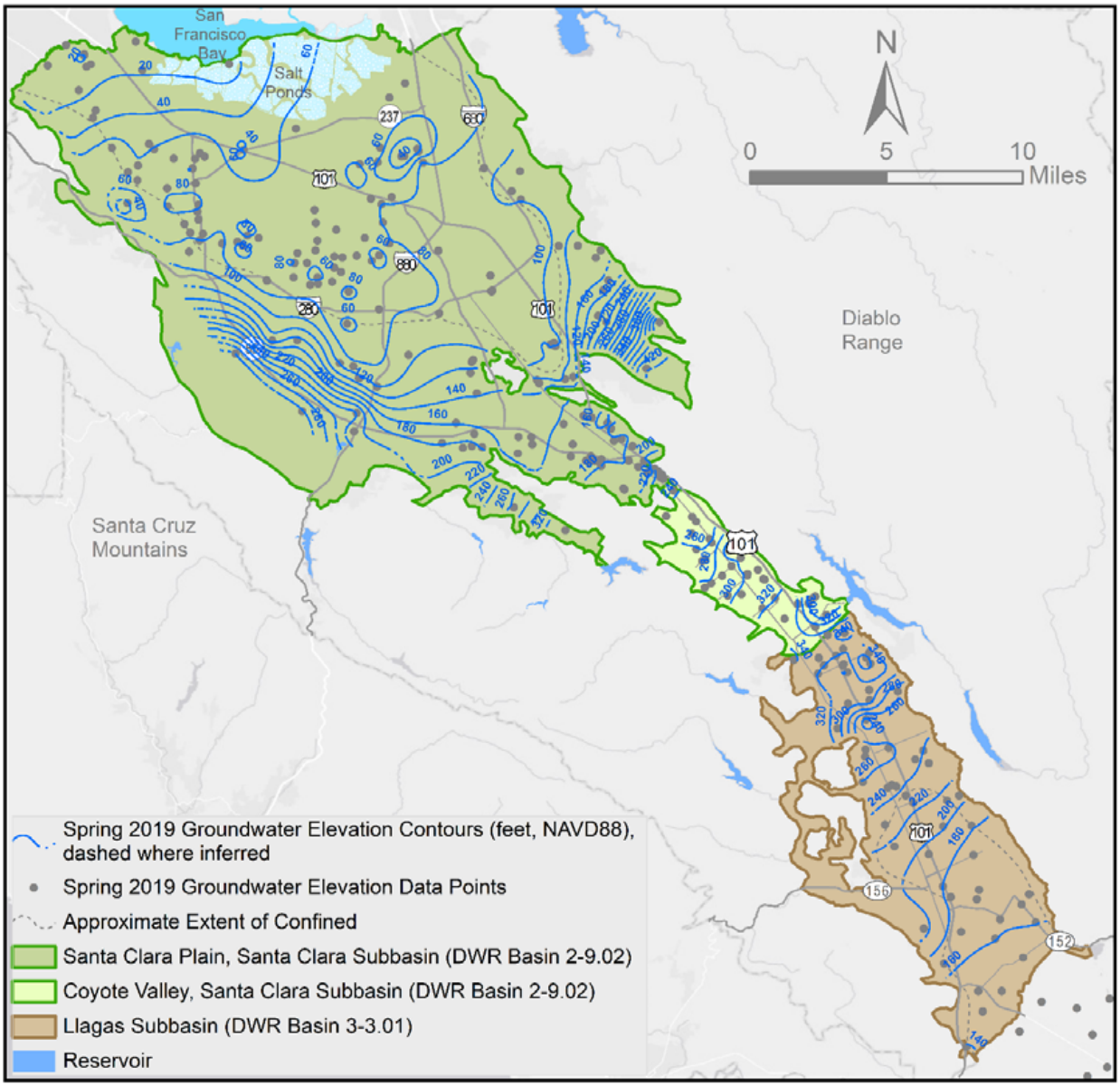
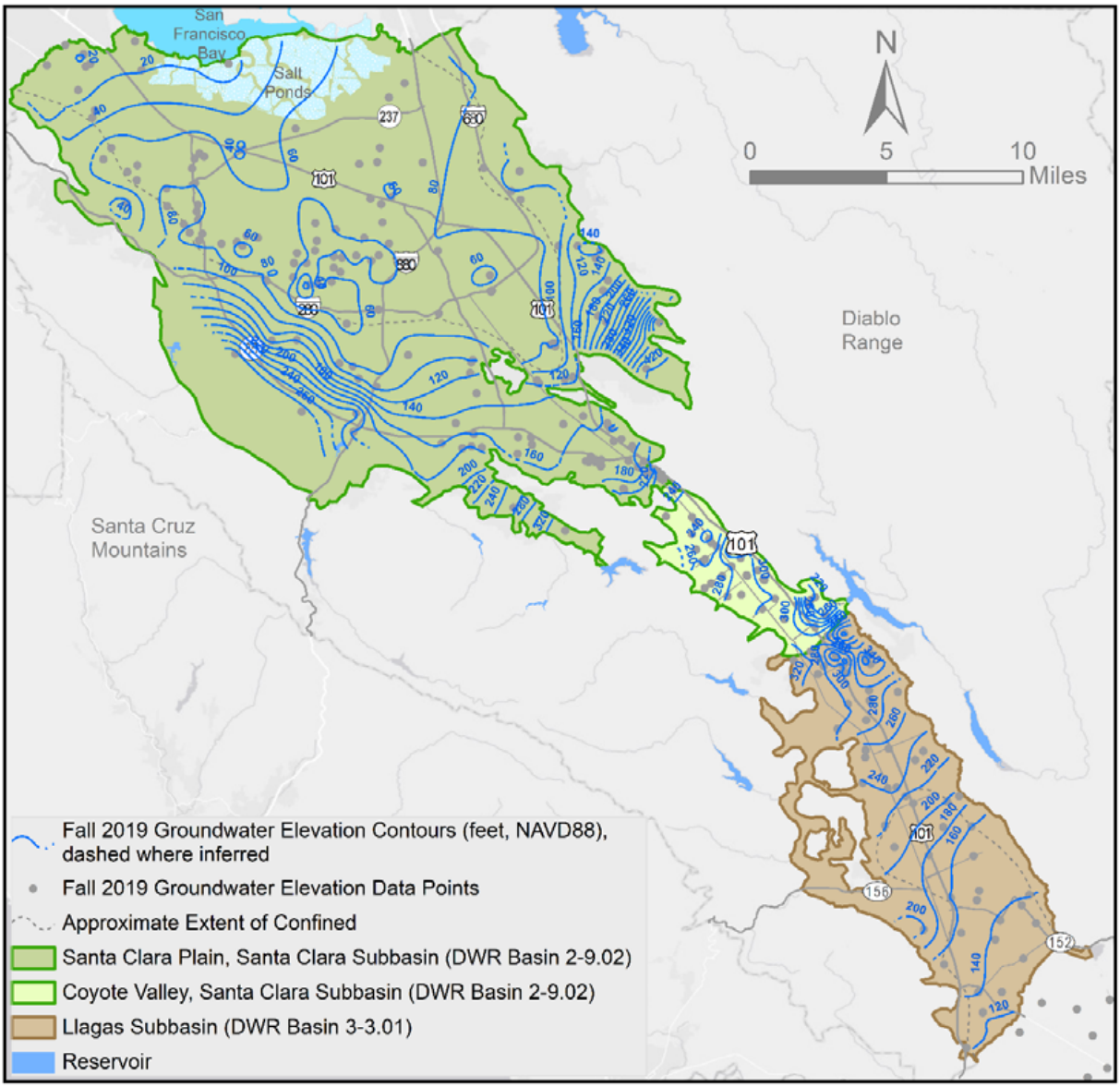


Figure 16. Fall 2019 Groundwater Elevation Contours in the Principal Aquifers



3.2 Groundwater Storage

Estimated countywide groundwater storage at the end of 2019 was 356,700 AF; this is well above the GWMP outcome measure of 300,000 AF, and 15,200 AF greater than 2018 (Table 6). End of year groundwater storage above 300,000 AF falls within the normal stage (Stage 1) of Valley Water's Water Shortage Contingency Plan, indicating good water supply conditions. The end of year storage for 2020 is projected to be well above the 300,000 AF target.

Table 6. Estimated End of Year Groundwater Storage (AF)

Groundwater Subbasin/Area	GWWP Outcome Measure	End of Year 2018	End of Year 2019	Change in Storage
Santa Clara Subbasin, Santa Clara Plain	278,000	309,400	315,700	+6,300
Santa Clara Subbasin, Coyote Valley	5,000	10,800	12,800	+2,000
Llagas Subbasin	17,000	21,300	28,200	+6,900
Total	**300,000**	**341,500**	**356,700**	**+15,200**

Note: Groundwater storage estimates presented are as of December 2019. These estimates are based on accumulated groundwater storage since 1970, 1991, and 1990 for the Santa Clara Plain, Coyote Valley, and Llagas Subbasin, respectively. These estimates are refined as additional pumping and managed recharge data become available.

Groundwater Storage Outcome Measures

Valley Water met each of the three storage outcome measures in 2019 as shown below.

OM 2.1.1.a.: Greater than 278,000 AF of projected end of year groundwater storage in the Santa Clara Plain.
Outcome measure met: End of 2019 groundwater storage is 315,700 AF.

OM 2.1.1.b.: Greater than 5,000 AF of projected end of year groundwater storage in the Coyote Valley.
Outcome measure met: End of 2019 groundwater storage is 12,800 AF.

OM 2.1.1.c.: Greater than 17,000 AF of projected end of year groundwater storage in the Llagas Subbasin.
Outcome measure met: End of 2019 groundwater storage is 28,200 AF.

CHAPTER 4 – LAND SUBSIDENCE

Subsidence is a concern due to historical occurrence in the Santa Clara Plain and because it can lead to an increased risk of flooding, saltwater intrusion into groundwater, and damage settlement-sensitive infrastructure and utilities. In 2019, Valley Water monitored for subsidence at 138 benchmarks along three cross valley land surface level circuits and at two extensometers in the Santa Clara Plain. Groundwater levels at ten subsidence index wells were also monitored and compared to thresholds established at each well to minimize the risk of permanent land subsidence. The subsidence outcome measure was met in 2019 with subsidence below the threshold of 0.01 feet per year. In fact, close to zero subsidence occurred in 2019 in the Santa Clara Plain, indicating very good conditions. Subsidence has never been observed in the Coyote Valley or the Llagas Subbasin, so there is no related outcome measure in those areas.

Between 1915 and 1969, land subsidence occurred in the Santa Clara Plain due to groundwater overdraft, with more than 13 feet of inelastic (permanent) land subsidence observed in San Jose. Inelastic subsidence was essentially halted by about 1970 through Valley Water's expanded conjunctive water management programs, which facilitated the return of groundwater to levels well above subsidence thresholds. Elastic (non-permanent) subsidence and recovery occurs annually in response to seasonal pumping and recharge as indicated by satellite studies and extensometer measurements (Appendix A).[17] To avoid resumption of inelastic subsidence, Valley Water has established subsidence thresholds at ten index wells in the Santa Clara Plain.[18] A tolerable rate of 0.01 feet per year of subsidence was used to determine thresholds at these wells.[19] These subsidence thresholds are the groundwater levels above which groundwater must be maintained to ensure a low risk of land subsidence.

Valley Water conducts ongoing monitoring of land surface benchmarks, extensometers, and groundwater levels at subsidence index wells to determine if land subsidence is occurring and threatening to exceed established thresholds. The subsidence monitoring network is shown in Figure 17. Recent monitoring data from land benchmark surveys, extensometers, and subsidence index wells indicate that there is low risk of subsidence, as described further below and in the 2019 Subsidence Data Analysis Technical Memorandum (Appendix A).

4.1 Extensometer Monitoring

Valley Water monitors two 1,000-foot deep extensometers that measure aquifer compaction or expansion, associated with subsidence or uplift, by comparing vertical ground elevation relative to a central, isolated pipe set beneath the water-bearing units. The extensometers, located in Sunnyvale near Moffett Field ("Sunny") and near downtown San Jose ("Martha"), are equipped with data loggers to provide hourly aquifer compaction/expansion and water level readings. Valley Water evaluates the average land subsidence measured during the last 11 years at two extensometers to determine if it meets the tolerable rate of land subsidence of 0.01 feet per year[2].

Over the last 11 years (2009 to 2019), a negative average annual rate of subsidence (-0.006 feet per year) was measured at the extensometers (Figure 18), which is indicative of uplift (or aquifer expansion) and is below the tolerable subsidence rate of 0.01 feet per year. The average annual rate for the previous 11-year period (2008 to 2018) was -0.004 feet per year. The decreased value in 2019 results from continued high groundwater levels throughout much of the Santa Clara Plain.

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[17] Schmidt, D. A., and R. Bürgmann, 2003, Time-dependent land uplift and subsidence in the Santa Clara valley, California, from a large interferometric synthetic aperture radar data set, *J. Geophysical Res., 108* (B9), 2003.

[18] Geoscience Support Services Inc. for Santa Clara Valley Water District, Subsidence Thresholds in the North County Area of Santa Clara Valley, 1991.

[19] The tolerable subsidence rate of no more than 0.01 feet per year on average was endorsed by Valley Water's Water Retailer Groundwater Subcommittee.

4.2 Benchmark Elevation Surveys

Periodic benchmark surveys of land surface elevation have been conducted in Santa Clara County since 1912.[20] Valley Water's current benchmark leveling program consists of annual surveys along three cross valley level circuits in the Santa Clara Plain (Figure 17). In 2019, Valley Water analyzed land surface elevation data from 138 benchmarks to evaluate the spatial variability of land subsidence. 2019 survey data indicate little change of the land surface elevation from 2018. Figure 19 presents the average annual change of land surface elevation along the three circuits over the last 11 years from 2009 to 2019. It shows that subsidence (or negative values) was observed at some locations and uplift (or positive values) at most locations. No subsidence exceeding 0.01 feet per year was observed. The tolerable rate of subsidence of 0.01 feet per year was met during this period.

4.3 Subsidence Index Wells

Groundwater level measurements are an integral part of land subsidence monitoring because declining water levels due to long-term overdraft were the driving force of historical subsidence in the Santa Clara Plain. Valley Water measures water levels at ten subsidence index wells on a daily to monthly basis to determine if water levels are nearing established subsidence thresholds. If water levels stay near or drop below subsidence thresholds for extended periods, permanent land subsidence may resume, resulting in an increased risk of flooding, saltwater intrusion, and damage to infrastructure and utilities.

Figure 20 shows groundwater levels and subsidence thresholds at the ten subsidence index wells. The lowest historical water levels were generally observed in the 1960s and 1970s. Since then, groundwater levels have recovered, primarily due to Valley Water's managed recharge and in-lieu recharge programs. Similar to the regional groundwater elevation index wells, 2019 average water levels are close to or at historic highs in all subsidence index wells, indicating a full recovery of the groundwater resource since the last drought. Three subsidence index wells located near the Baylands continue to have upward vertical gradients and artesian conditions. In addition to keeping water levels above subsidence thresholds, maintaining an upward hydraulic gradient in the principal aquifer zone is critical for preventing shallow groundwater with elevated salts from entering the principal aquifer through abandoned wells and other vertical conduits. Valley Water will continue to frequently track data from the subsidence index wells to support water supply operations and planning.

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[20] USGS, Land Subsidence in the Santa Clara Valley, California as of 1982, Professional Paper 497-F, 1988.

Figure 17. Land Subsidence Monitoring Network

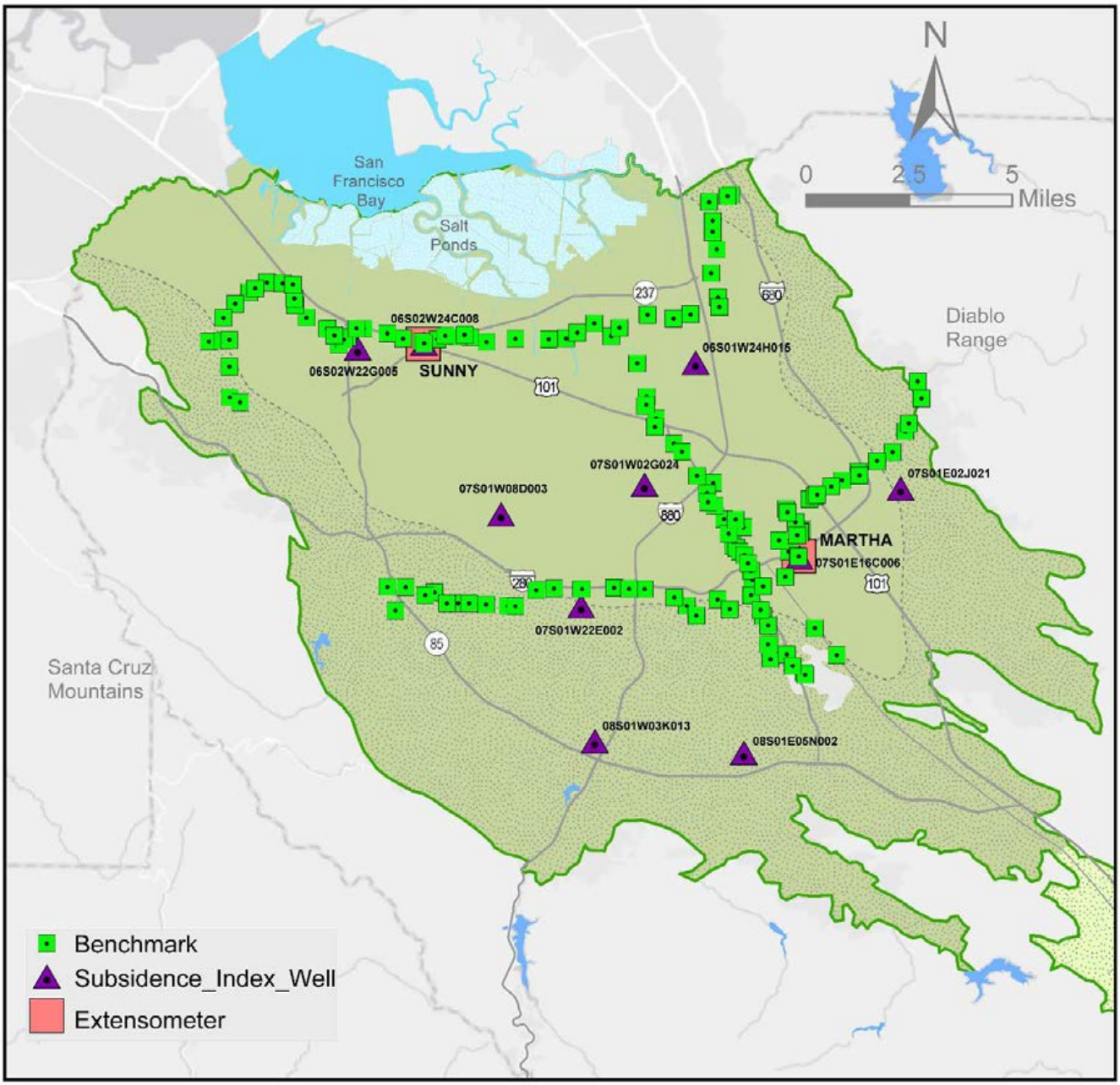
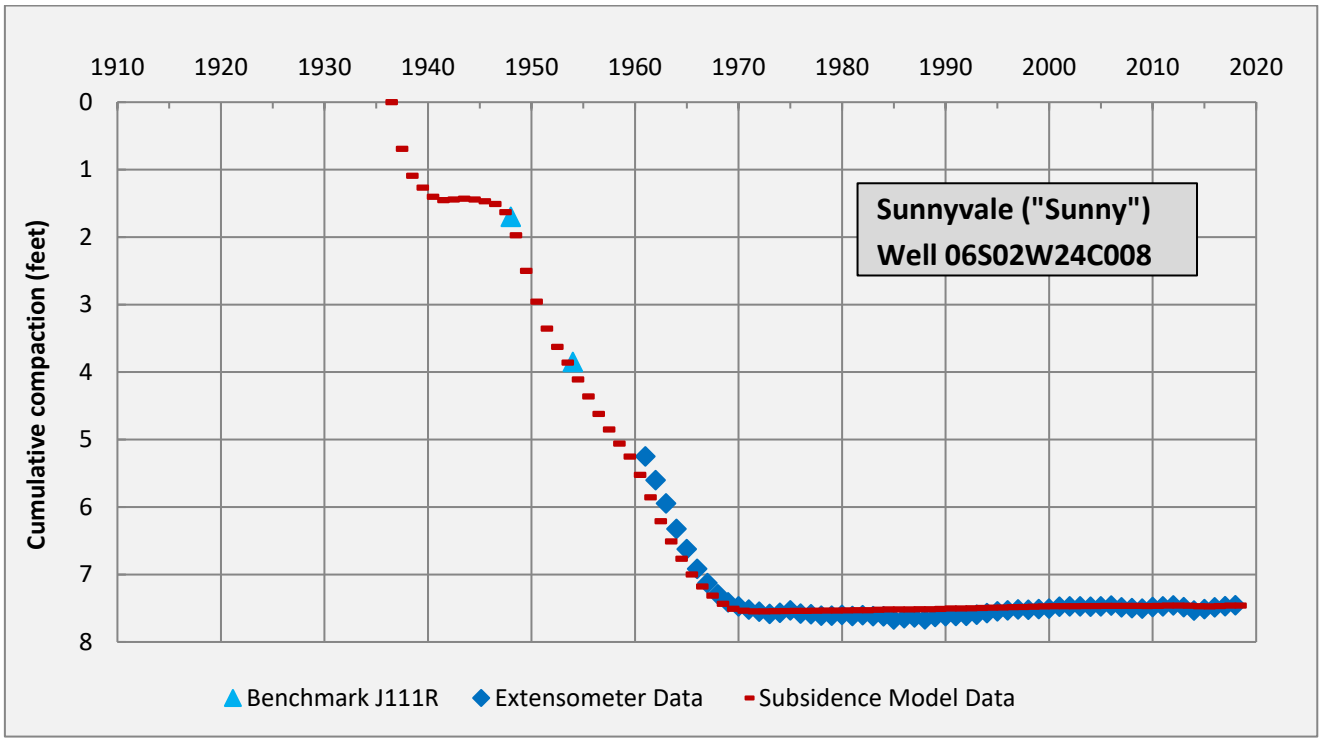


Figure 18. Cumulative Compaction at Extensometers



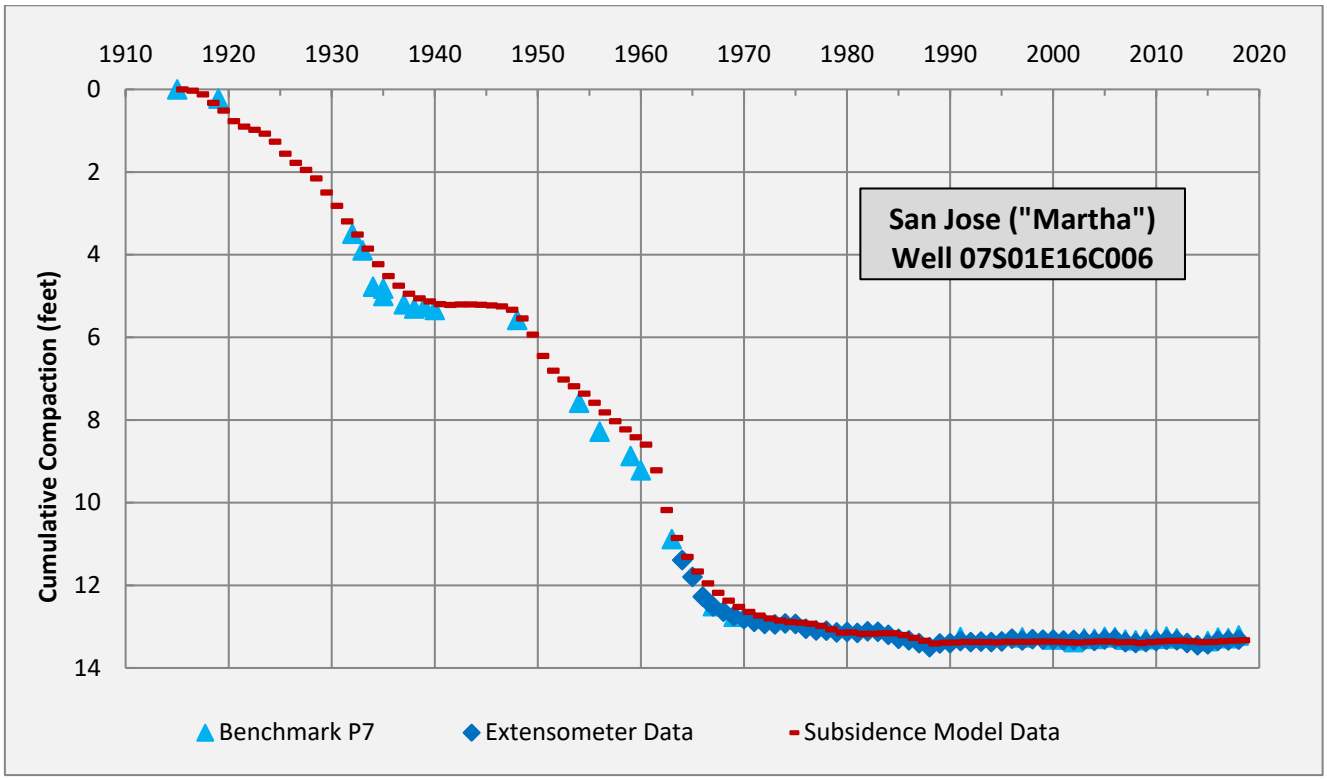
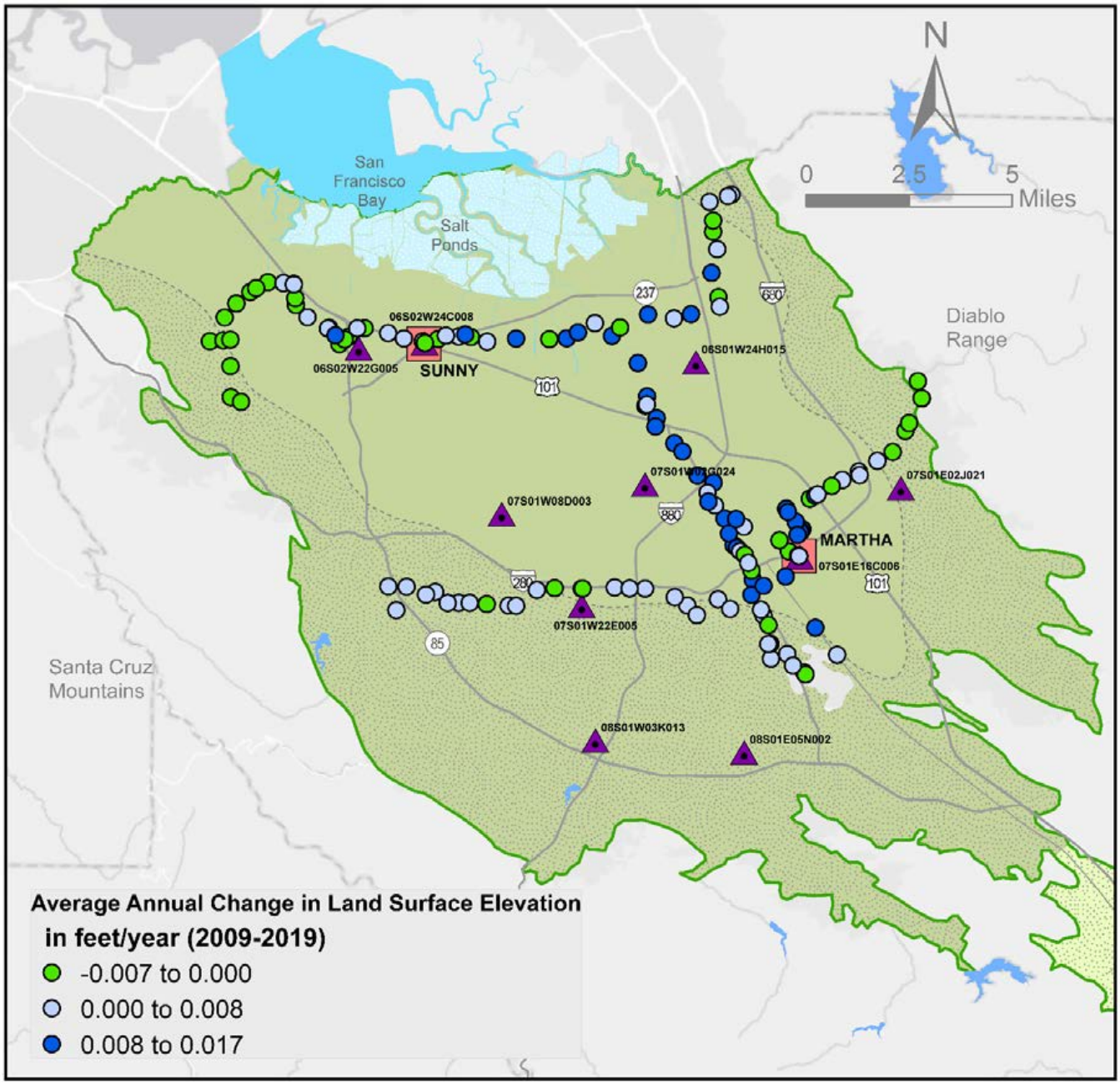


Figure 19. Average Annual Change of Land Surface Elevation between 2009 and 2019



Note: positive values indicate land surface uplift and negative values indicate land surface subsidence in Figure 19.

Figure 20. Groundwater Levels at Santa Clara Plain Subsidence Index Wells (feet, NAVD88)

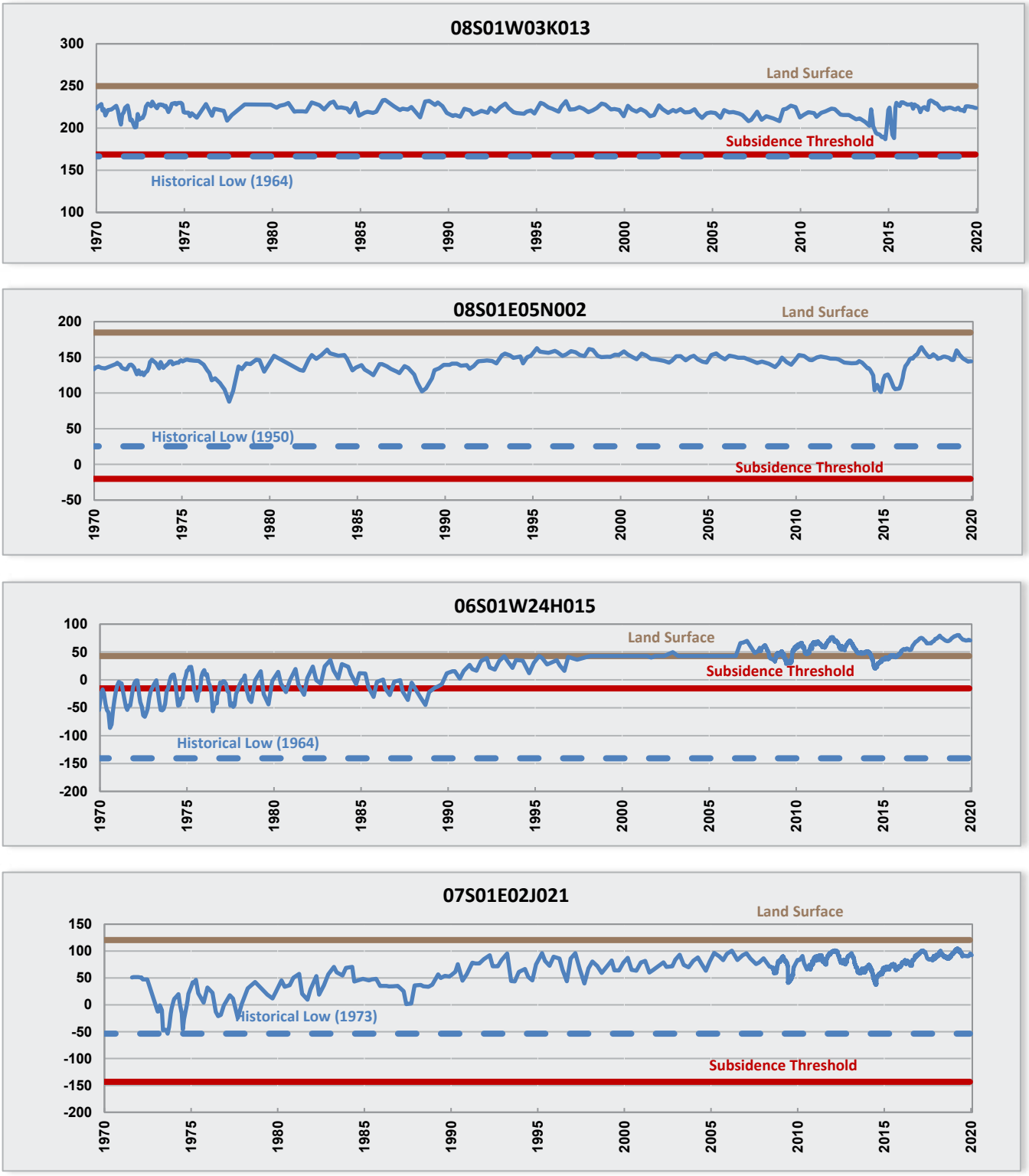


Figure 20. Groundwater Levels at Santa Clara Plain Subsidence Index Wells (feet, NAVD88 continued)

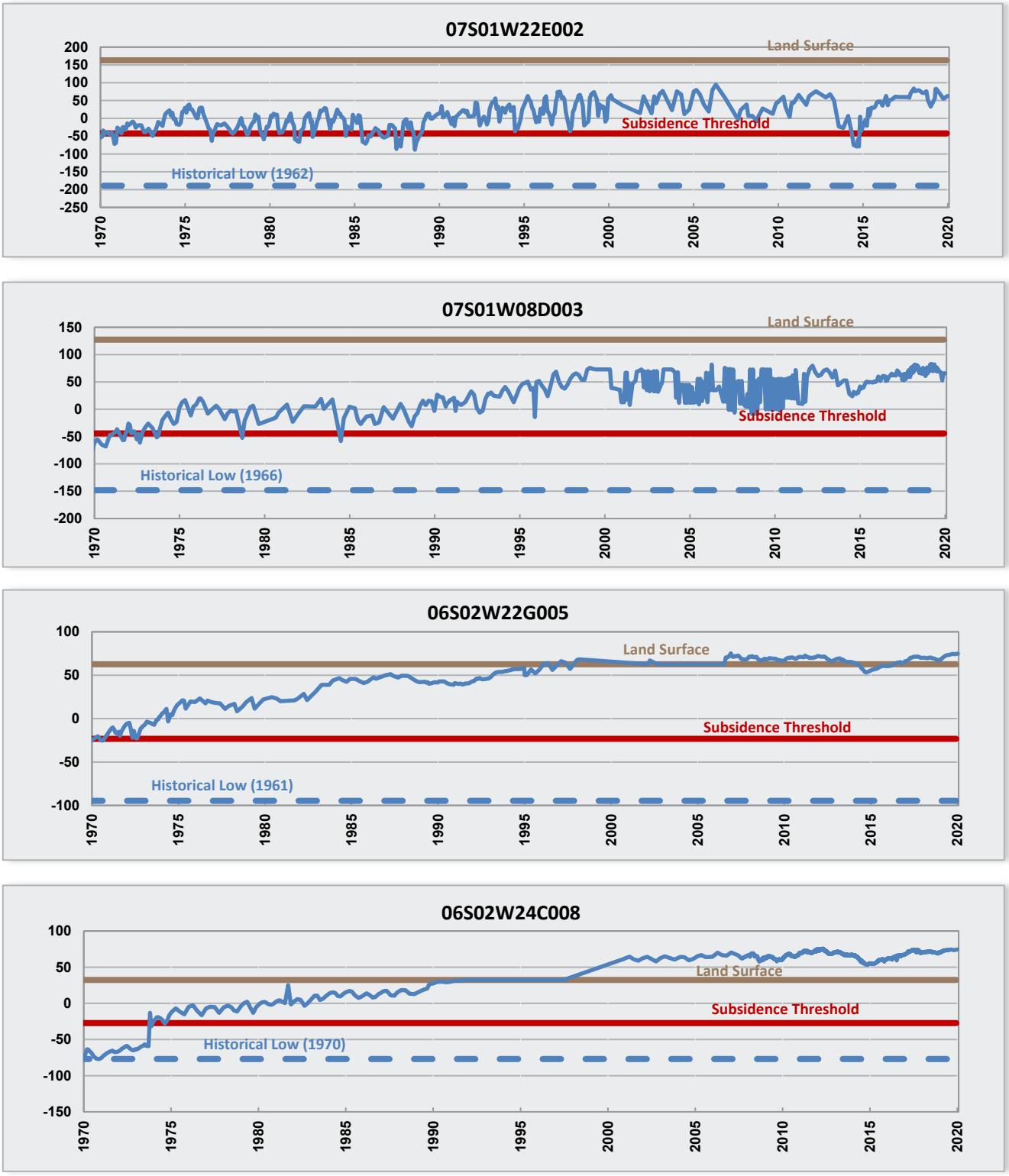
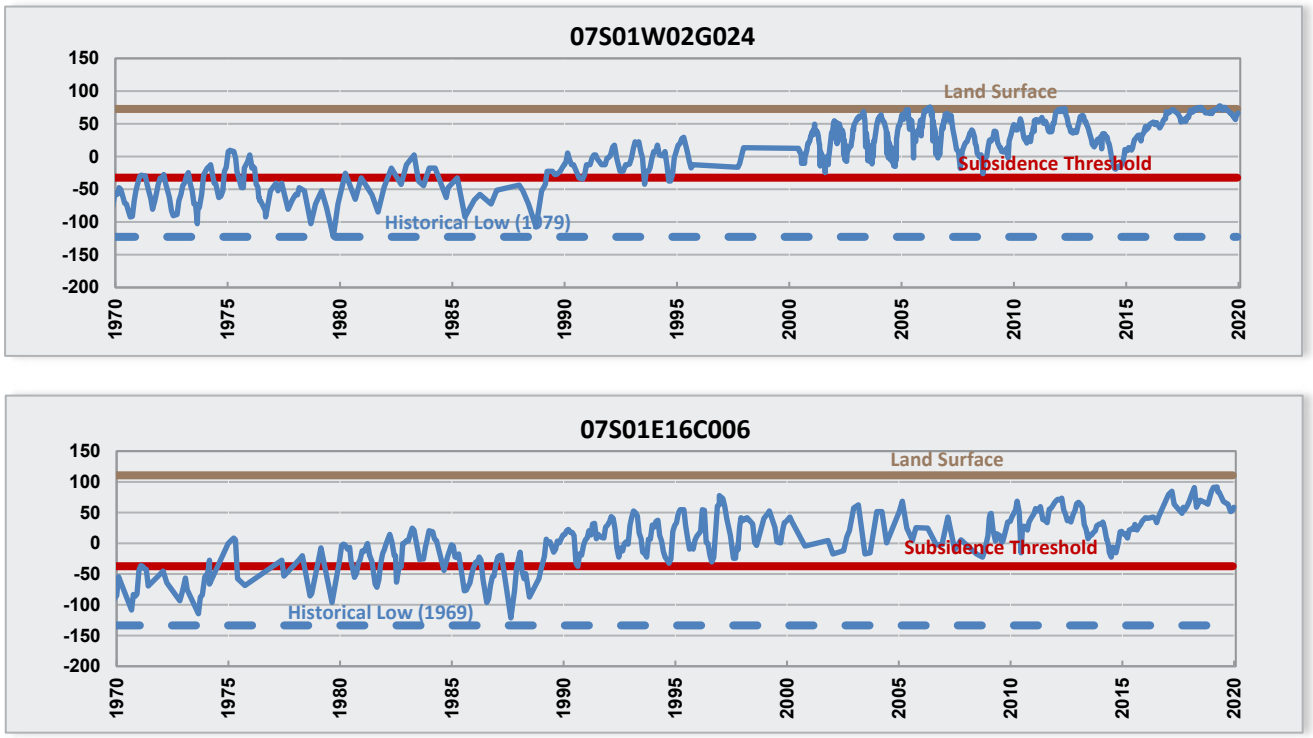


Figure 20. Groundwater Levels at Santa Clara Plain Subsidence Index Wells (feet, NAVD88 continued)



Land Subsidence Outcome Measure

As shown in Figures 19 and 20 and described in this chapter, Valley Water's land subsidence outcome measure was met in 2019.

OM 2.1.1.d.

100% of subsidence index wells with groundwater levels above subsidence thresholds.
This outcome measure was met. Groundwater levels were above subsidence thresholds at all ten Santa Clara Plain subsidence index wells.

CHAPTER 5 – GROUNDWATER QUALITY

In 2019, Valley Water collected groundwater samples from 254 wells and analyzed the water quality. This included 85 dedicated monitoring wells and domestic wells that are sampled each year, 144 domestic wells tested through a voluntary sampling program, and 25 located wells near recycled water irrigation sites. Valley Water also analyzed groundwater quality data from 232 public water supply wells.[21] Summary results for water supply wells are provided in the Annual Groundwater Quality Summary Report (Appendix B). Summary tables of analyzed parameters with the median and range for each subbasin and aquifer zone[22] for all regional wells sampled are provided in Appendix C. These tables do not include results from wells near recycled water irrigation sites, which are included in Appendix E.

Water quality testing indicates that groundwater in the Santa Clara and Llagas Subbasins meets drinking water standards in most wells for all parameters tested. The exception is nitrate, which was found above regulatory standards in 23% of South County water supply wells sampled (primarily domestic wells) due to historic and on-going sources. The Salt and Nutrient Management Plan[23] implementation supports reduced nitrate loading and exposure. Valley Water also offers eligible domestic well owners free water testing for nitrate, as well as rebates of up to $500 for qualifying nitrate treatment systems.

During 2019, Valley Water conducted water quality sampling of the Coyote, Los Gatos, and Westside recharge systems. No parameters were detected above primary or secondary drinking water standards in 2019, nor since the program began in 2006. Water quality from these three recharge systems provides a high-quality water supply source for recharge into the Santa Clara and Llagas Subbasins. Recharge water quality sampling results for 2019 are summarized in Section 5.4 and related tables are provided in Appendix D.

Valley Water also monitors groundwater quality at wells near recycled water irrigation sites. In 2019, Valley Water analyzed data from 10 monitoring wells in the Santa Clara Plain and 20 wells in the Llagas Subbasin. In the Santa Clara Plain, there are mixed concentration trends for basic water quality parameters. Groundwater in the Llagas Subbasin generally shows stable or decreasing concentration trends for key recycled water indicators. Based on an analysis of wastewater indicators, concentration trends and geochemistry, it appears that some changes in both subbasins may be due to recycled water irrigation. Related results are summarized in Section 5.5 and data tables are provided in Appendix E.

Valley Water continues to track emerging technical and regulatory issues related to per- and polyfluoroalkyl substances (PFAS), a group of widely used but unregulated chemicals with known and suspected adverse health effects. Valley Water conducts ongoing PFAS sampling near recycled water irrigation sites in the Llagas Subbasin. In 2020, Valley Water expanded efforts to determine the extent and occurrence of PFAS in groundwater throughout Santa Clara County, including regional sampling.[24] Results indicate that PFAS are detected in some wells, but not widely present above current State health-advisory levels. The 2020 sampling data and interpretation will be included in the CY 20 Annual Groundwater Report.

Valley Water continues to coordinate with local, state, and federal agencies managing cleanup of groundwater contamination sites by tracking progress on high-priority sites and issuing recommendations for effective remediation. Valley Water will continue to track water quality changes and work with stakeholders to identify ways to protect groundwater quality from the threat of contamination.

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[21] Data for public water systems is available from the State Water Resources Control Board Division of Drinking Water website.
[22] Public water supply wells were assumed to represent the principal aquifer is no construction information was available, as these are typically deep wells.
[23] https://www.valleywater.org/your-water/where-your-water-comes-from/groundwater/groundwater-studies
[24] https://www.valleywater.org/your-water/where-your-water-comes-from/groundwater/groundwater-quality

5.1 Regional Groundwater Quality

Valley Water analyzed groundwater quality at 85 locations that are sampled annually, including 64 monitoring wells and 19 domestic wells (Figure 21). Sixty-nine samples were analyzed for almost 100 water quality parameters including major and minor ions, nutrients, trace metals, and volatile organic compounds (VOCs). Water from 16 shallow monitoring wells near the San Francisco Bay, used for salt water intrusion monitoring, were analyzed for ions and metals only. The regional groundwater quality evaluation also incorporates data from 50 wells with known construction sampled through Valley Water's voluntary domestic well sampling program and data from 232 public water supply wells sampled by public water systems and reported to the State Water Resources Control Board Division of Drinking Water (DDW).

To evaluate regional conditions, water quality results are compared to state and federal water quality standards and to prior year results. A summary table of sampled parameters showing the median and range for each subbasin and aquifer zone[25] is provided in Appendix C. Results indicate that groundwater in the Santa Clara and Llagas subbasins is generally of high quality. Water quality indicators, ions, and trace elements were within the normal range expected in groundwater, except for nitrate. Elevated nitrate concentrations are primarily an issue in South County due to historic and ongoing sources including synthetic fertilizer, septic systems, and animal enclosures.

Median concentrations for nitrate and TDS were compared to historical median concentrations and plotted over time (Figure 22). The median nitrate concentrations in the Santa Clara Plain shallow and principal aquifers in 2019 were 0.8 and 3.1 milligrams per liter (mg/L) as nitrogen (N), respectively, a decrease when compared to last year. Compared to 2018, the 2019 median for TDS is marginally higher in the Santa Clara Plain principal aquifer. The 2019 median concentration for TDS is the Coyote Valley is similar to 2018. The 2019 median concentrations in the Llagas Subbasin shallow and principal aquifers were 6.1 and 4.7 mg/L, respectively, a decrease when compared to last year. The 2019 TDS median concentrations in the Llagas Subbasin are similar to 2018.

Median nitrate values were below the drinking water standard of 10 mg/L in all three management areas. Median values for TDS were at or below 451 milligrams per liter (mg/L) in all groundwater management areas, below the secondary MCL. Fluctuations in annual sample medians are expected due to the number of wells tested with annual sampling recurrence, the number of wells tested with known well depths, annual recharge, pumping, and rainfall. Overall, median nitrate and TDS concentrations in the principal aquifers of the Santa Clara and Llagas subbasins remain stable (Figure 22). The evaluation of groundwater quality trends at five, ten, and fifteen-year periods, which also indicate generally stable or decreasing long-term trends, are presented in Section 5.2.

Eighteen VOCs, which include disinfection byproducts, were detected in groundwater in 2019, as summarized and listed by subbasin in Table C-4 (Appendix C). However, none were confirmed to be present above the Maximum Contaminant Level (MCL) and maximum concentrations were typically well below the MCL. VOCs occur primarily from industrial use of solvents and from leaking underground fuel tanks. No pesticide compounds were detected above the MCL in 2019.

[25] Public water supply wells were assumed to represent the principal aquifer if no construction information was available, as these are typically deep wells.

Figure 21. CY 2019 Groundwater Quality Monitoring Wells

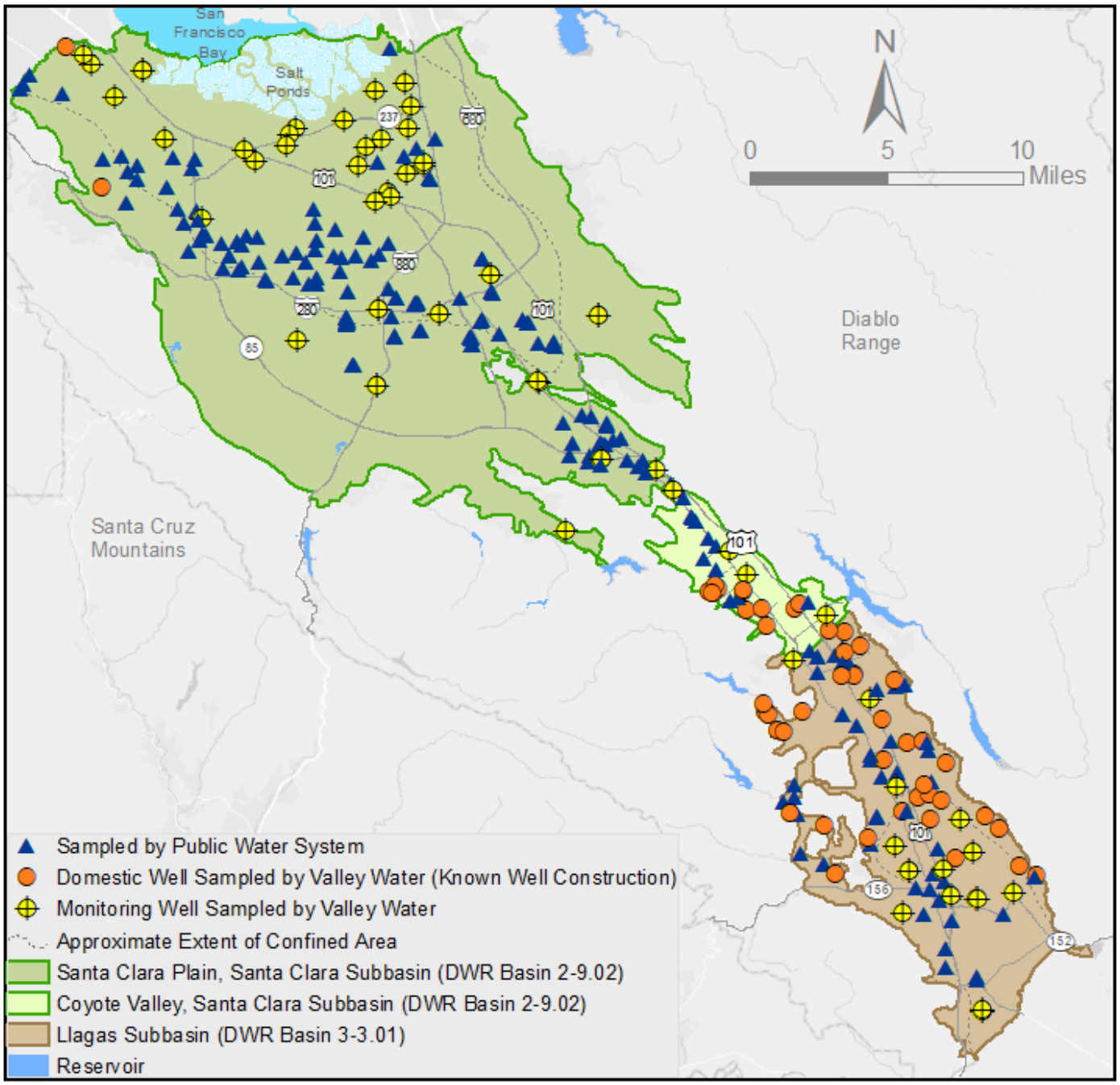
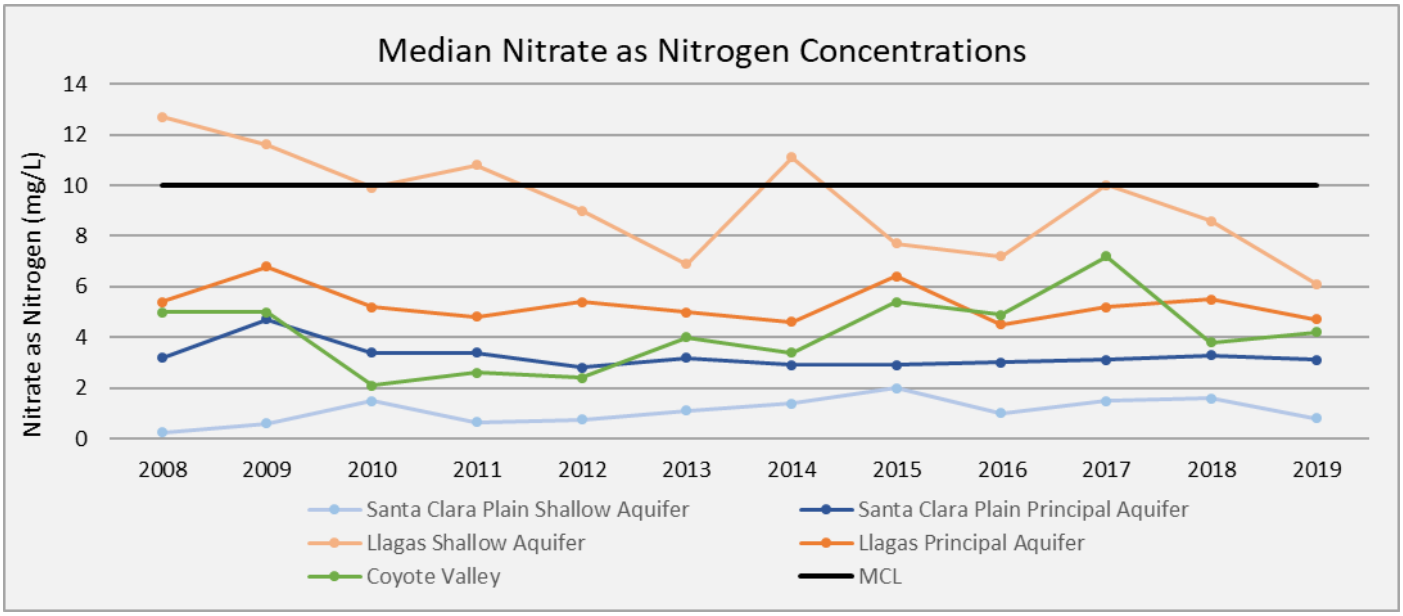
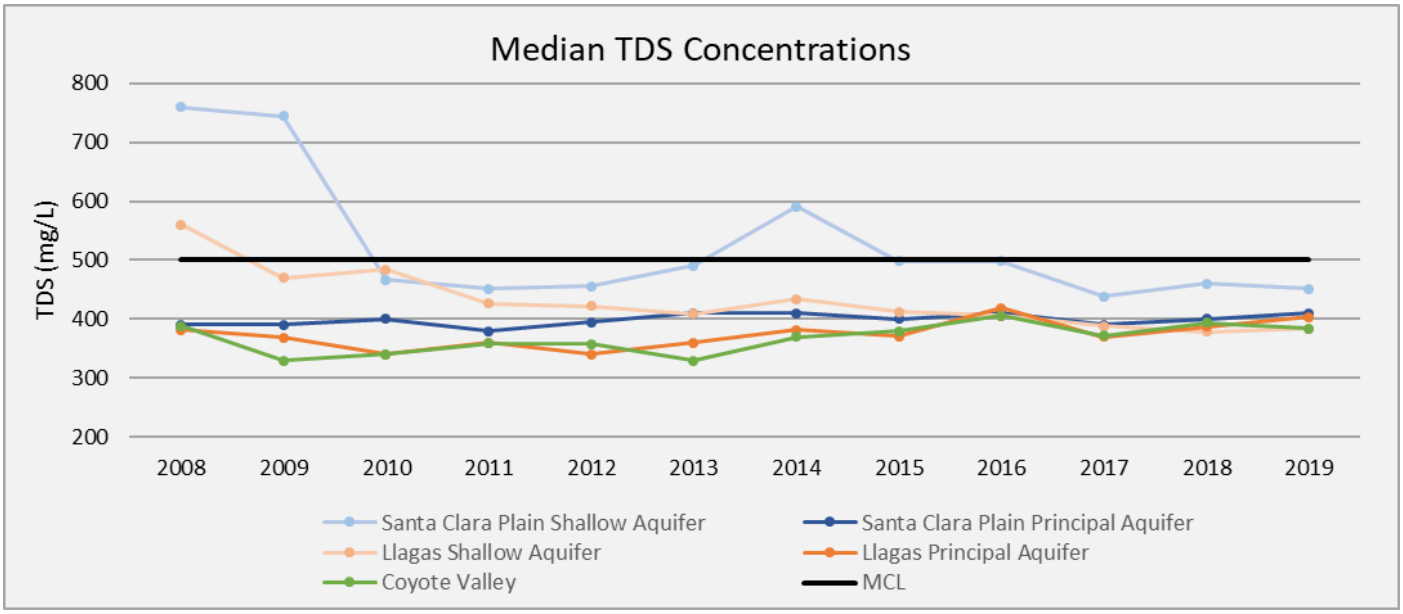


Figure 22. Median Nitrate and TDS by Subbasin and Aquifer Zone (mg/L)





Notes:

1. The shallow and principal aquifer zones are represented by wells primarily drawing water from depths less than and greater than 150 feet below ground surface, respectively.
2. Nitrate as Nitrogen has a health-based MCL of 10 mg/L. TDS has an aesthetic-based MCL, which ranges from 500 to 1,000 mg/L (recommended and upper limit, respectively).
3. Information shown is from monitoring wells, public water supply wells, and domestic wells for which construction information is available. The set of wells sampled each year varies.
4. Median TDS in the Santa Clara Plain shallow aquifer excludes certain wells near San Francisco Bay within the region influenced by salt water interaction.

Comparison to Drinking Water Standards

Except for nitrate, all water supply wells tested, including public and private domestic wells, met all MCLs. Figure 23 shows the locations of water supply wells tested in 2019 with an MCL exceedance.[26] For public water supply wells, 97% met all MCLs, while 74% of all domestic wells met MCLs for the parameters tested (typically fewer parameters compared to public wells).

Nitrate was below its primary MCL of 10 mg/L in 87% of all water supply wells countywide. However, nearly one-fourth of the South County water supply wells tested in 2019 exceeded the nitrate MCL, with 11% of public water supply wells and 28% of domestic wells having at least one result above the MCL. Most detections were from private domestic wells that are not regulated by the state, while seven wells were part of public water systems, which must comply with all drinking water standards. Based on communication with private well owners participating in Valley Water sampling programs, many use bottled water for drinking and cooking, or reverse osmosis treatment to reduce nitrate exposure.

While not used as a source of drinking water, some monitoring wells sampled are screened in the principal aquifer zone. One deep monitoring well in the Llagas Subbasin sampled in 2019 had a nitrate detection above the MCL. Eight shallow aquifer zone monitoring wells in the Llagas Subbasin sampled in 2019 also had nitrate detections above the MCL. Shallow groundwater quality is important, even though it is generally not used as a source of drinking water, because it is a potential water supply source and because shallow groundwater recharges the principal aquifer in recharge areas.

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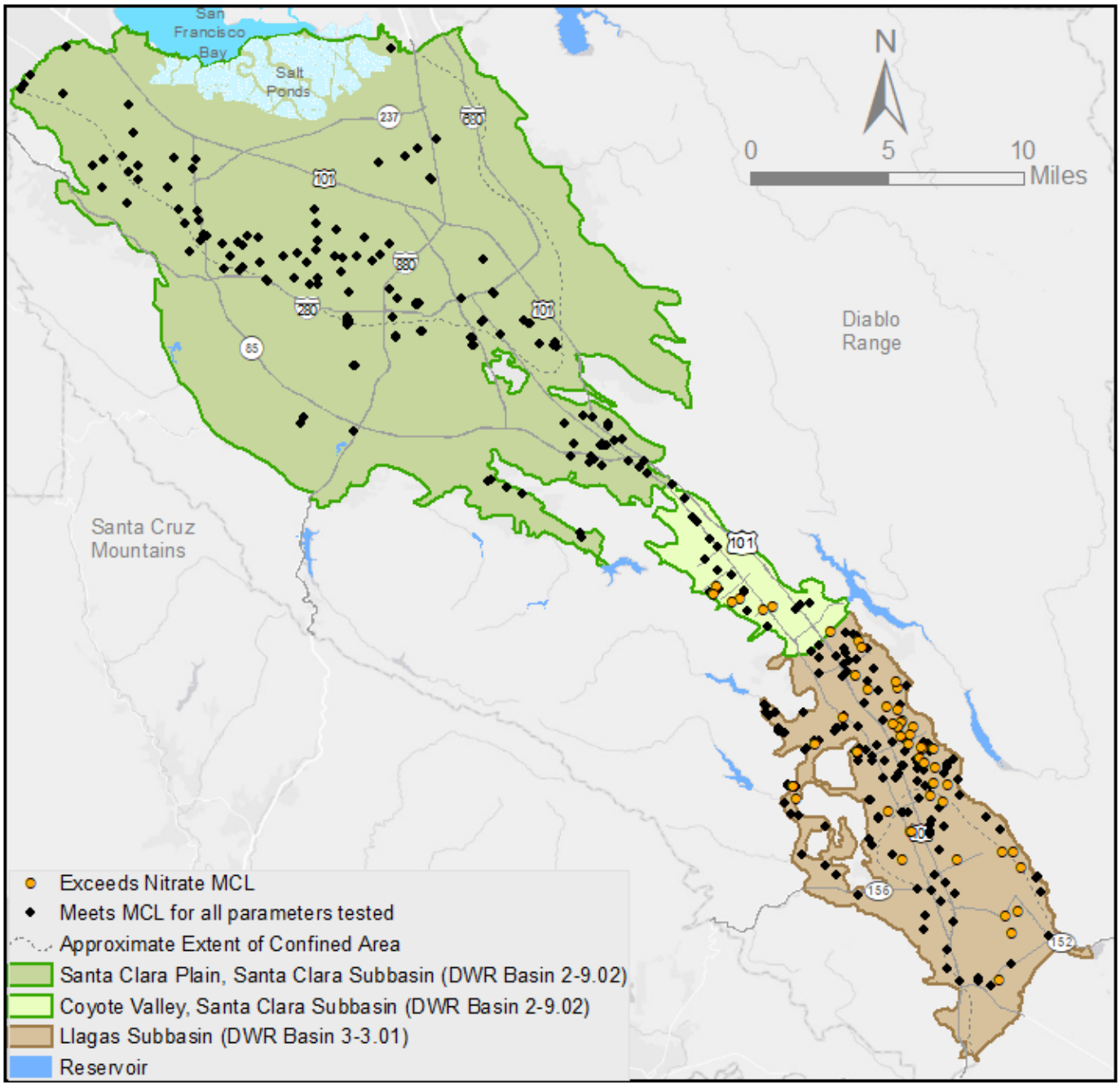
[26] For data obtained from the DDW website, any confirmed result reported above an MCL is considered an exceedance for the purposes of this report. Based on DDW regulations and follow-up sampling, a single detection above an MCL may not constitute a violation of a drinking water standard.

Figure 23. CY 2019 MCL Exceedances at Water Supply Wells



Unregulated Contaminant Monitoring

The U.S. Environmental Protection Agency (EPA) has developed a systematic process for evaluating whether individual chemicals should be regulated to ensure that drinking water poses no significant risk to the public. Every five years, the EPA publishes a list of unregulated compounds to be analyzed in large public water systems through the Unregulated Contaminant Monitoring Rule (UCMR). The EPA uses the UCMR to collect data on contaminants that are suspected to be present in drinking water and do not have health-based standards set under the Safe Drinking Water Act. The EPA has completed three rounds of UCMR: UCMR 1 with monitoring between 2001 and

2003, UCMR 2 with monitoring between 2008 and 2010, and UCMR 3 with monitoring between 2013 and 2015. UCMR 3 results for groundwater in Santa Clara County (sampled by water retailers) were summarized in Valley Water's Annual Groundwater Report for 2016. UCMR 4 monitoring will occur between 2018 and 2020 and includes a total of 30 contaminants including cyanotoxins, metals, pesticides and related byproducts, disinfection byproducts, alcohols, and semi-volatile organic chemicals. UCMR 4 sampling results will be evaluated and presented when available through the EPA.

Comparison to Agricultural Objectives

Agriculture in Santa Clara County is largely limited to the Coyote Valley and Llagas Subbasin. South County groundwater quality was evaluated against agricultural water quality objectives from the applicable Regional Water Quality Control Board Basin Plans[27] to assess its suitability. Because Valley Water has limited access to agricultural wells, water supply well data was used in this evaluation. One hundred percent of all South County water supply wells met Basin Plan agricultural objectives.

5.2 Groundwater Quality Trends

To assess changes in water quality over time, chloride, nitrate, and TDS concentrations were evaluated using a variety of techniques over a 15-year period (2005 – 2019) for all groundwater management areas and aquifer zones. Statistical trend tests applied to individual wells required at least five sample results. Trend analysis results show that most wells have stable or decreasing chloride, nitrate, and TDS concentration trends, although some upward trends are observed (Figures 24 through 26 and Table 7). Trend analysis results for each groundwater management area are discussed below.

Santa Clara Plain Shallow Aquifer Zone

Chloride concentration trends are stable or decreasing in most wells (80%) from the Santa Clara Plain shallow aquifer (Table 7). However, geographic coverage in certain areas is limited. Six wells (20%) were identified as having an upward trend. Of the six wells, five show gradual and slowly increasing trends with rates of change ranging between 0.5 and 2 mg/L per year. A much greater change rate is observed at one well influenced by its juxtaposition to an intertidal reach of Guadalupe River. Most of the shallow wells with increasing chloride concentrations are in the area affected by saltwater intrusion. Within the same area, however, are three shallow wells with downward chloride trends.

Nitrate trends in the shallow aquifer zone are all stable or downward. Four wells have downward trends with rates of reduction ranging from 0.05 to 0.37 mg/L per year Nitrate as Nitrogen.

TDS trends are stable or decreasing in most wells drawing from the shallow aquifer zone. Three wells were found to have upward trends, one showing a modest increase of about 10 mg/L per year and two having much greater rates of change. The well with greatest increases in TDS is the same as that previously identified above as having a very steep chloride trend line. No other wells had increasing concentrations of both TDS and chloride.

Santa Clara Plain Principal Aquifer Zone

Most wells in the principal aquifer zone of the Santa Clara Plain (86%) exhibit stable chloride trends. Thirteen percent of wells tested show increasing chloride trends with one well showing a downward chloride trend. Plots of wells having increasing trends show gentle and slowly increasing trends with most having rates of change of less

[27] Groundwater in the Coyote Valley is compared to the "limit" field in Table 3-6 of the San Francisco Bay Basin Water Quality Control Basin Plan (May 2017). Groundwater in the Llagas Subbasin is compared to the upper range of the "increasing problems" range in Table 3-1 and Table 3-2 (irrigation supply) of the Water Quality Control Plan for the Central Coast Basin (June 2019).

than 1 mg/L per year with a few up to about 3 mg/L per year.

Nitrate trends differ substantially from chloride in that many more wells are showing a downward trend (28%). In 62% of wells, no trend is observed. Increasing trends, however, were found in 31 wells (10%) examined. These trends are mostly gradual increases with rates of change estimated between 0.04 and 0.26 mg/L per year nitrate as nitrogen. Downward trends are numerous (67 wells) and most show about the same rate of reduction (~0.1 mg/L per year) with a few exceptions showing more accelerated reduction.

Ninety-three percent of wells tested drawing from the principal aquifer zone do not show any significant change in TDS over the 15-year trend evaluation period. The eight wells (6%) showing increasing trends show rates of change of about 5 mg/L per year, except one well having a rate of about 13 mg/L per year. The location of wells with increasing TDS are shown on Figure 26.

Coyote Valley

Two wells (11%) in Coyote Valley were identified as having an upward chloride trend, while the remainder did not exhibit any trends during the period studied. Wells with upward chloride trends were estimated to be increasing at a rate of about 0.5 and 0.8 mg/L per year.

Most data for Coyote Valley suggest groundwater nitrate levels are unchanging or decreasing during the period examined. Three wells (10%) exhibit slight upward trends with rates of increase ranging from 0.04 to 0.19 mg/L per year Nitrate as Nitrogen with one well stabilizing toward the end of the trend period.

All wells except one indicate TDS concentration is not changing over the study period. The one well with an upward trend has a modest rate of increase estimated at about 6 mg/L per year. Its current TDS concentration is about 380 mg/L. If the rate of change is sustained and remains constant it would take about 20 years for this well to exceed the recommended limit for TDS of 500 mg/L.

Llagas Subbasin Shallow Aquifer Zone

Stable chloride concentrations were found in 62% of wells tested in the shallow aquifer zone. The remainder of wells showed evidence of upward trending concentrations over the period examined, a higher percentage than all other groundwater management areas. No wells showed evidence of decreasing chloride concentrations. Disposal of consumed water via septic systems could explain the greater incidences of upward chloride trends.

In about 75% of wells, nitrate concentrations showed no significant evidence of change over the trend study period. Two wells (12%) showed evidence of increasing concentrations and an equal number with downward trends. One of the wells with increasing nitrate trends shows an abrupt increase in slope around 2012. A linear trend line fitted to the data indicates a rate of change of about 2 mg/L per year nitrate as nitrogen. The other well with an increasing trend has small increases, by comparison, with a rate of change of about 0.1 mg/L per year nitrate as nitrogen.

Three wells were noted as having an increasing TDS trend. TDS concentration trend in one well mirrors that of nitrate as described above as having a sharp increase in slope around 2012. The rate of change is much higher than the other two wells with increasing trends. One well with data only through 2012 indicated a downward trend. The remaining 17 wells did not exhibit any evidence of TDS concentration trend.

Llagas Subbasin Principal Aquifer Zone

In the principal aquifer zone of Llagas Subbasin, 13 wells (24%) showed evidence of increasing concentrations of chloride. Most wells have relatively low concentrations and rates of change less than 1 mg/L per year. Two wells show much greater rates of change (up to 3 mg/L per year). One well was found to have a downward chloride concentration trend. At most wells tested (74%), there was insufficient evidence in the data to assert trend.

Thirty-nine percent of wells indicate downward trending concentrations of nitrate. Fitted trend lines indicate rates of reduction ranging from 0.05 to nearly 0.95 mg/L per year nitrate as nitrogen. Sixty-one percent of wells showed no evidence of changing concentrations. Eight (9%) wells had upward trending concentrations with rates of increase ranging from about 0.04 to 0.24 mg/L per year.

Ninety-six percent of wells in the principal aquifer zone of the Llagas Subbasin show no trend in TDS, two wells have upward trend and no wells have downward trends. Rates of increase of TDS in the two wells are about 7 and 10 mg/L per year as based on fitted trend lines.

All Groundwater Management Areas

The majority of all wells have stable or decreasing concentrations of chloride, nitrate, and TDS. A total of 82%, 91%, and 94% of all wells have stable or decreasing concentrations of chloride, nitrate, and TDS, respectively (Table 7).

Table 7. Chloride, Nitrate, and TDS Concentration Trends (2005 – 2019)

Groundwater Management Area	Parameter	Number of Wells Evaluated	Percent of Wells with Stable Concentrations	Percent of Wells with Decreasing Concentrations	Percent of Wells with Increasing Concentrations
Santa Clara Plain Shallow Aquifer	Chloride	32	70%	10%	20%
	Nitrate (as N)	23	83%	17%	0%
	TDS	29	69%	21%	10%
Santa Clara Plain Principal Aquifer	Chloride	145	86%	1%	13%
	Nitrate (as N)	240	62%	28%	10%
	TDS	143	93%	1%	6%
Coyote Valley	Chloride	18	89%	0%	11%
	Nitrate (as N)	30	63%	27%	10%
	TDS	21	95%	0%	5%
Llagas Subbasin Shallow Aquifer	Chloride	21	62%	0%	38%
	Nitrate (as N)	17	76%	12%	12%
	TDS	21	81%	5%	14%
Llagas Subbasin Principal Aquifer	Chloride	54	74%	2%	24%
	Nitrate (as N)	92	61%	30%	9%
	TDS	54	96%	0%	4%
All Groundwater Management Areas	Chloride	268	80%	2%	18%
	Nitrate (as N)	402	63%	27%	9%
	TDS	268	90%	3%	6%

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Figure 24. Chloride Concentration Trends (2005 - 2019)

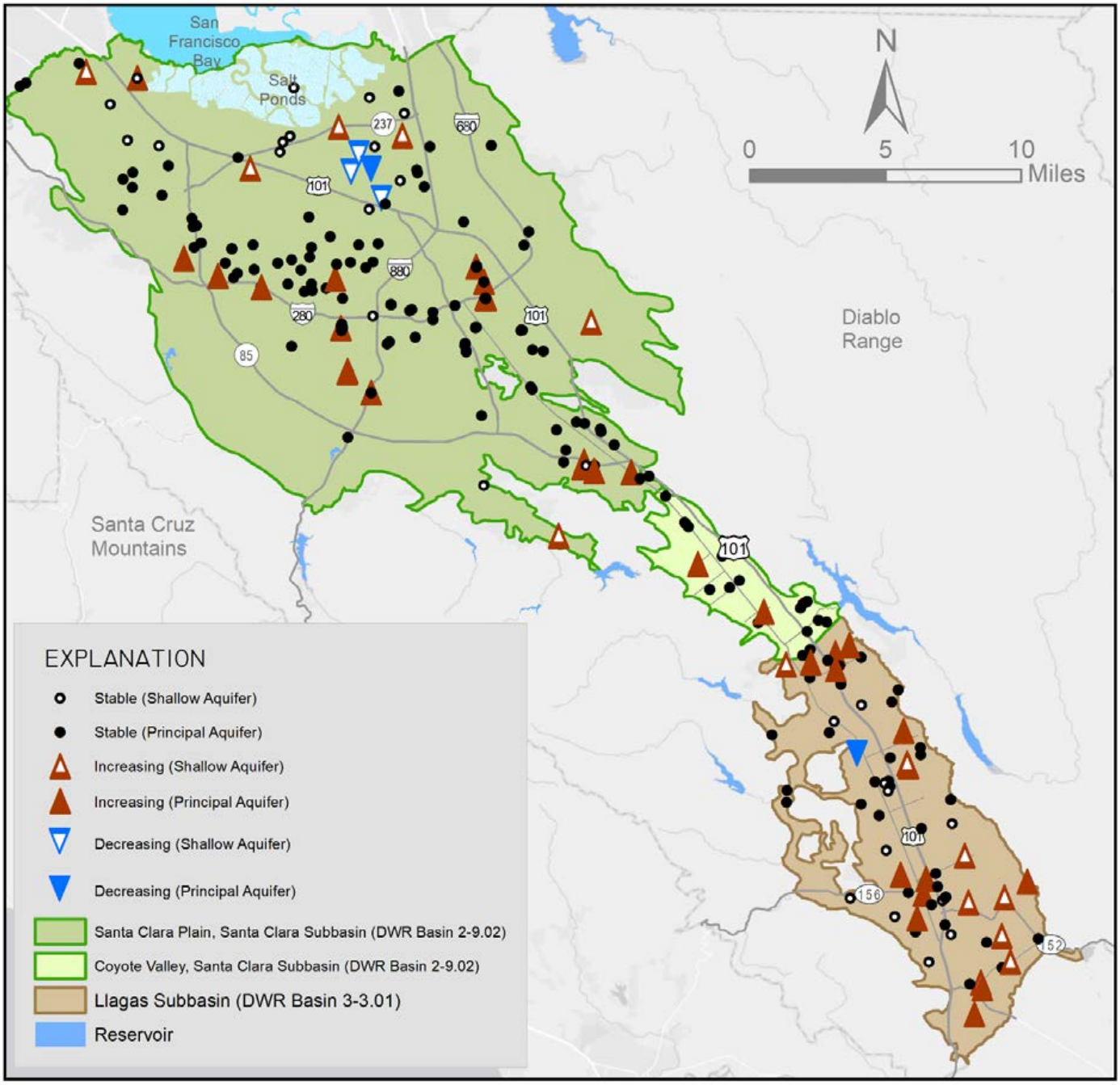


Figure 25. Nitrate Concentration Trends (2005 - 2019)

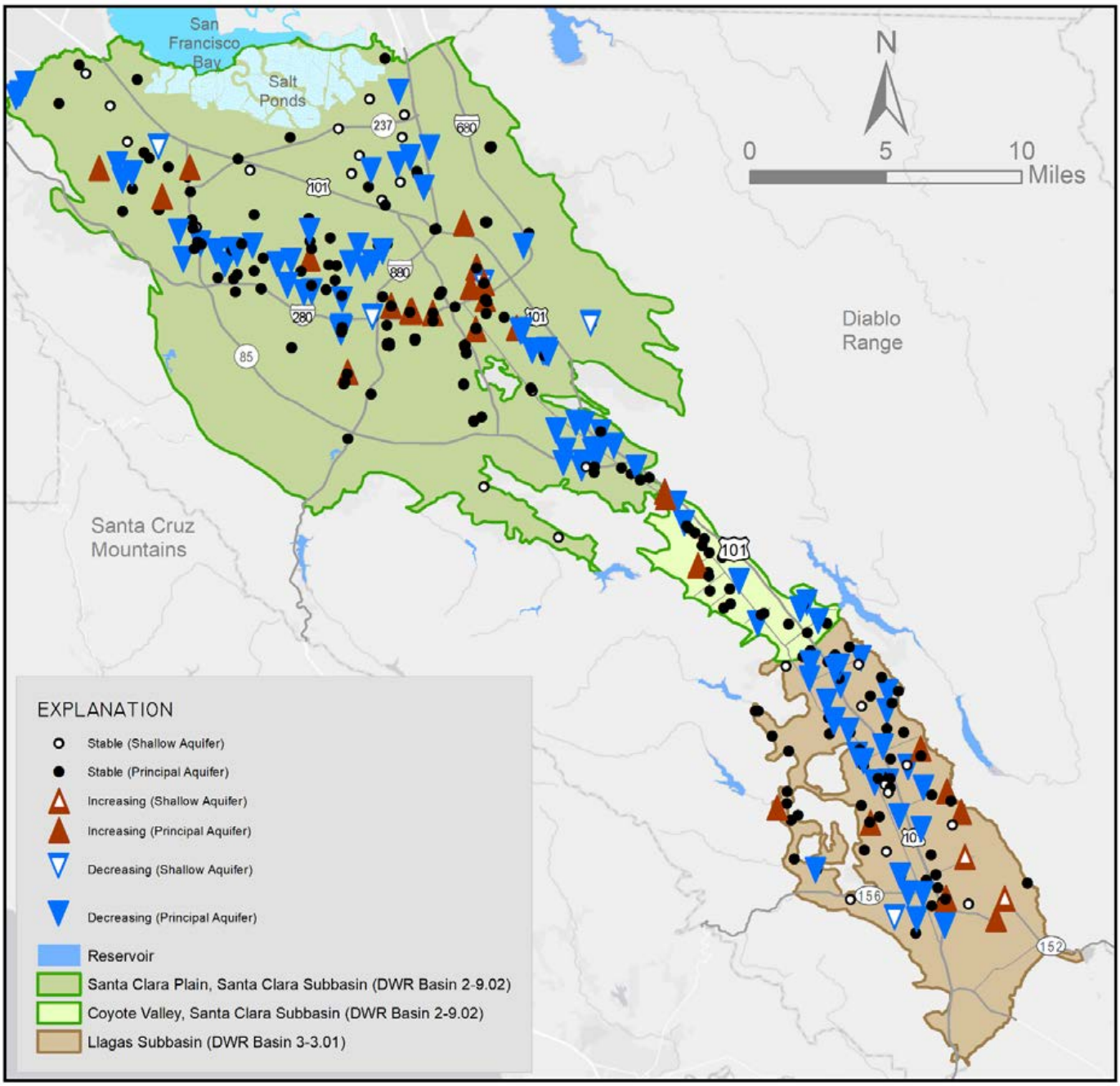
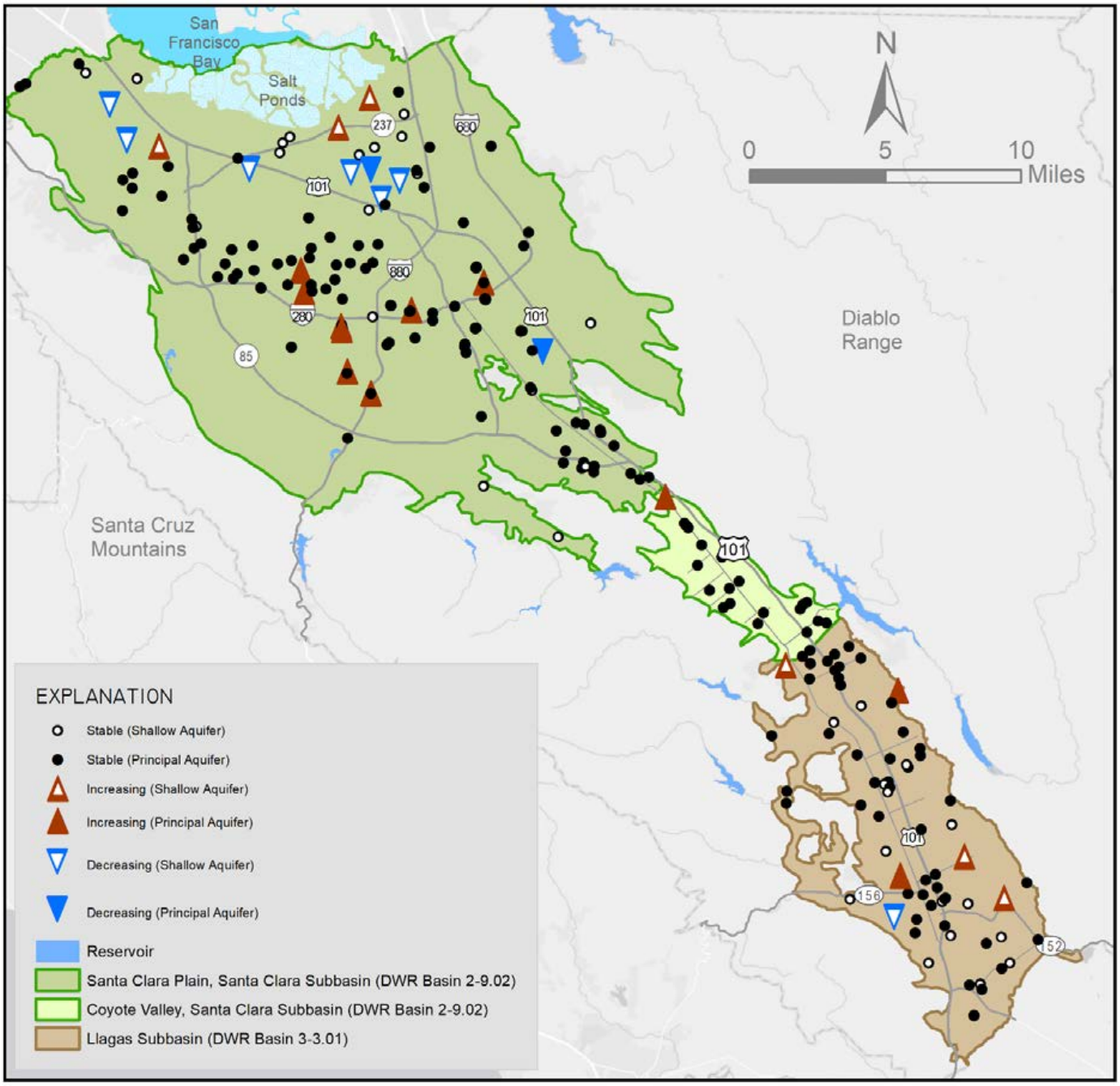


Figure 26. Total Dissolved Solids (TDS) Concentration Trends (2005 - 2019)



Step Trend Analyses

Valley Water also conducted a five, ten, and fifteen-year statistical step trend analysis of nitrate, TDS, and chloride concentrations by groundwater management area for all areas. Differences between data groups is suggestive of changing concentrations within the designated timeframe. Results show no significant change among all groups (Table 8). The highest achieved confidence (~87%) was the 15-year step for chloride in Coyote Valley but was still below the significance level of 95%, using the Mann-Whitney test. The 15-year step trend data sets for nitrate, TDS, and chloride by groundwater management area are represented below using boxplots (Figure 27).

Table 8. Total Dissolved Solids, Nitrate, and Chloride Step Trend Outcome in Principal Aquifers

	5-Year Step Trend[1]	10-Year Step Trend	15-Year Step Trend
Total Dissolved Solids (TDS, mg/L)			
Santa Clara Plain	No Change	No Change	No Change
Coyote Valley	No Change	No Change	No Change
Llagas Subbasin	No Change	No Change	No Change
Nitrate (as Nitrogen, mg/L)			
Santa Clara Plain	No Change	No Change	No Change
Coyote Valley	No Change	No Change	No Change
Llagas Subbasin	No Change	No Change	No Change
Chloride (mg/L)			
Santa Clara Plain	No Change	No Change	No Change
Coyote Valley	No Change	No Change	No Change
Llagas Subbasin	No Change	No Change	No Change

Notes:

1. The median 2019 concentration for each groundwater management area was compared to that of 5 years ago (2014), 10 years ago (2009), and 15 years ago (2004) to determine if there is any statistically significant difference using the Mann-Whitney test at the 95% confidence level.

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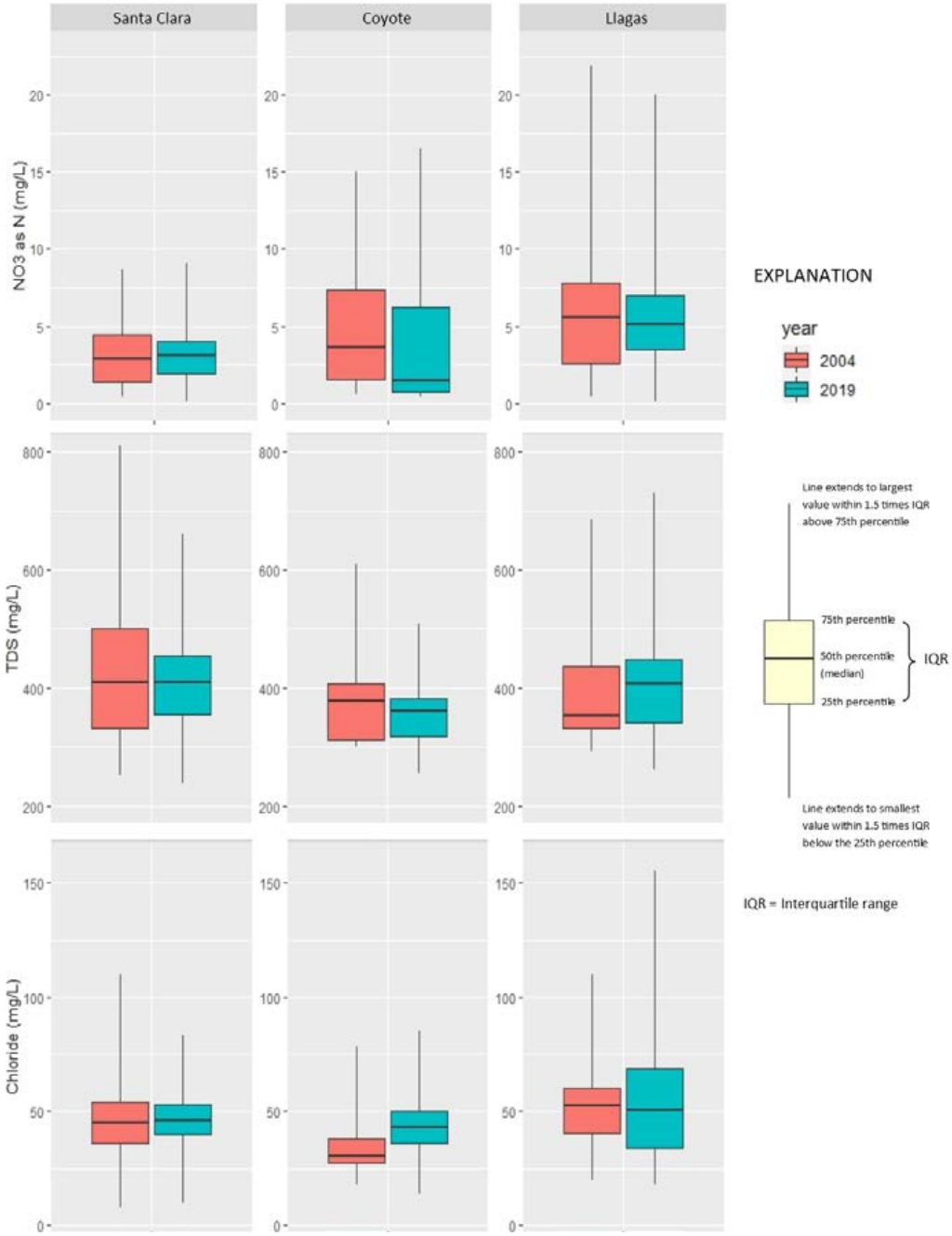
Figure 27. Boxplots Representing Fifteen-year Step Trend Groups by Groundwater Management Area and Trend Parameter



Notes:

1. No significant difference between paired-groups (Mann-Whitney test, 95% confidence).
2. Some outliers present but not all shown within plot y-axis scale

Groundwater and Salt Water Interaction

Salt water intrusion into shallow aquifers was observed historically near South San Francisco Bay and adjacent to the tidal reaches of the Guadalupe River, Coyote Creek, and other creeks in the northern portion of the Santa Clara Plain. The mechanism for this intrusion is not the classic case occurring in coastal aquifers where a wedge of sea water intrudes freshwater aquifers due to a hydraulic connection between groundwater and sea water. San Francisco Bay is a shallow feature (with average depth of 12 to 15 feet) underlain by the Bay Mud, which isolates the Bay from underlying aquifers. The Santa Clara Valley has experienced salt water incursion in streams from brackish water moving upstream, primarily in Coyote Creek and Guadalupe River, and being subsequently infiltrated to shallow aquifers that are not used to supply drinking water. As previously discussed, Valley Water has implemented managed recharge and in-lieu recharge programs to minimize the risk of groundwater overdraft, land subsidence, and salt water intrusion.

Chloride concentrations from shallow monitoring wells are used to assess groundwater and salt water interaction adjacent to southern San Francisco Bay and near tidal reaches of creeks. Valley Water uses a chloride concentration of 100 mg/L as a threshold to indicate that salt water is impacting groundwater. This is a conservative approach since the aesthetic based secondary MCL for chloride is 250 mg/L.

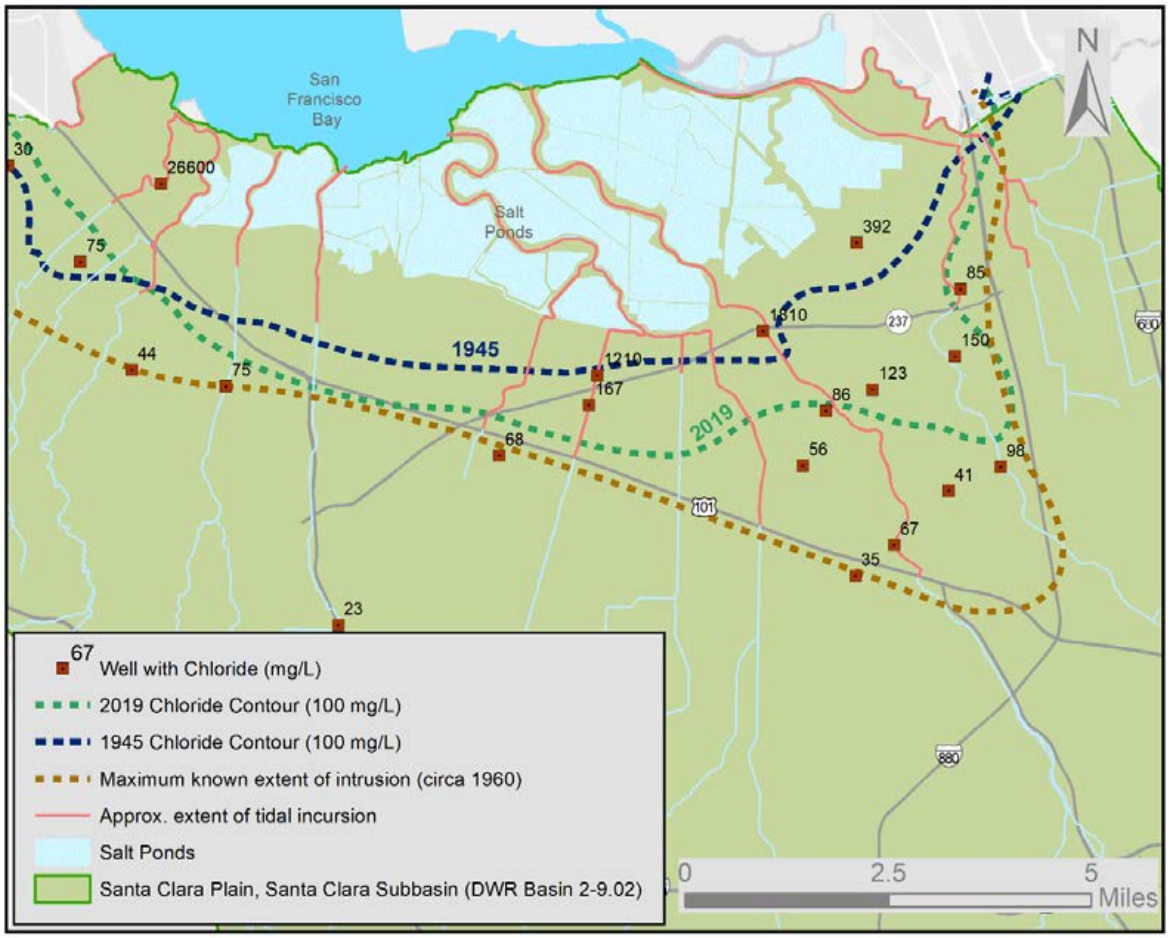
As shown on Figure 28, wells with chloride over 100 mg/L are in a narrow band near the former salt evaporation ponds, except in the areas adjacent to the tidal reaches of creeks (e.g., lower extent of the Guadalupe River and Coyote Creek). In these areas, a larger portion of the shallow aquifer is affected due to tidal influenced salt water incursion in these channels that occurs due to historic land subsidence. The affected area varies slightly from year-to-year. The maximum known extent of salt water intrusion is shown in Figure 28. Most shallow wells in this area have stable or decreasing long-term concentration trends for chloride, demonstrating that the salt water intrusion front appears to be stable or retreating due to improved groundwater conditions.

Few wells in the principal aquifer zone have ever had highly elevated TDS or chloride concentrations. Salt water intrusion into the principal aquifer, though rare, may occur by shallow saline groundwater moving down through vertical conduits, such as abandoned wells, when the vertical hydraulic gradient is downward.[28] At isolated locations in Palo Alto and southeast San Jose, the source of elevated TDS and chloride in deeper wells there has been attributed to connate water (trapped salt water from the geologic past), rather than recent salt water intrusion. Valley Water currently conducts only limited monitoring of the principal aquifer in the Baylands area because few deeper wells are available. Migration of saline shallow groundwater into the principal aquifer has been prevented due to Valley Water's managed and in-lieu recharge activities, which maintain artesian conditions (upward vertical gradient) in the Baylands area.[29] Tidal incursion in the bayward reaches of streams still occurs and it continues to introduce saline water into the shallow aquifer, as the observed elevated and increasing chloride concentration in some shallow aquifer wells in the Baylands area indicate.

[28] Vertical gradients in the Baylands area where salt water interaction occurs have been upward for the last 20 years (approximately).

[29] Artesian conditions are facilitated by the presence of a laterally-extensive clay layer (aquitard), which confines the pressure within the principal aquifer, and isolates the principal aquifer from saline intrusion and other contamination.

Figure 28. Groundwater and Salt Water Interaction in the Santa Clara Plain Shallow Aquifer



5.3 Domestic Well Water Quality

Valley Water offers free, basic water quality testing to domestic well owners within its groundwater benefit zones through the Domestic Well Testing (DWT) program. In 2019, 132 domestic wells in North County and 150 domestic wells in South County were tested through the DWT and annual groundwater sampling programs. Parameters tested include nitrate as nitrogen, fluoride, sulfate, TDS, hardness, bromide, orthophosphate, and bacteria. The number and locations of wells sampled under the DWT program vary by year based on voluntary participation. North County testing included 4 new wells and 11 repeat wells, while South County included 30 new wells and 99 repeat wells. Data from Valley Water's DWT and annual groundwater sampling programs are summarized in this section.

Domestic well testing helps improve Valley Water's understanding of the occurrence of common contaminants and helps private well owners understand their water quality, so they can make informed decisions. Although water quality in domestic wells is not regulated by the state, the comparison to state drinking water standards provides context for interpreting results. When testing domestic wells, Valley Water notifies well owners when any contaminants are present above drinking water standards or when bacteria is present and offers information on additional actions the well owner may wish to take. Table 9 summarizes North County and South County results, including median concentrations and percent of wells with concentrations above drinking water standards.

Nitrate

Of the wells tested, nitrate was not detected above the MCL in any North County domestic well but was detected over the MCL in 40 South County wells. Nitrate results are shown in Figure 29. The median nitrate concentrations in domestic wells in North and South County was 1.4 mg/L and 6.5 mg/L, respectively. The 2019 regional median nitrate concentrations for the principal aquifer in the Santa Clara Plain, Coyote Valley, and Llagas Subbasin (including public water supply wells which are typically deeper) were 3.1, 4.2, and 4.7 mg/L, respectively. Overall, the South County median nitrate concentration for domestic wells is similar to the median nitrate concentration in the Llagas Subbasin.

The continued presence of nitrate above the MCL in many domestic wells in Santa Clara County and many areas of California highlights the need for ongoing efforts by regulatory and land use agencies, agricultural operators, and groundwater management agencies like Valley Water to address elevated nitrate in groundwater. To reduce well owners' exposure to nitrate, Valley Water began implementation of a multi-year rebate program for nitrate treatment systems in the fall of 2013, funded by the Safe, Clean Water and Natural Flood Protection Program (Measure B, a countywide special parcel tax). In 2019, five nitrate treatment system rebates were issued. This effort complements outreach and other efforts to reduce nitrate loading in coordination with the Central Coast Water Board and other basin stakeholders.

TDS

TDS does not have a primary MCL or public health goal, but instead has a secondary MCL, which is based on aesthetic concerns. The secondary MCL for TDS in drinking water is 500 mg/L (recommended), 1,000 mg/L (upper), and 1,500 mg/L (short-term). Of the wells tested, TDS was detected above the recommended secondary MCL in three North County domestic wells and 28 South County domestic wells. One South County domestic well exceeded the upper secondary MCL and the short-term secondary MCL. The median TDS concentrations in domestic wells in North and South County were 383 mg/L and 396 mg/L, respectively. The 2019 regional median TDS concentrations for the principal aquifer in the Santa Clara Plain, Coyote Valley, and Llagas Subbasin were 410 mg/L, 384 mg/L, and 404 mg/L, respectively.

Bacteria

Testing for bacteria included total coliform and Escherichia coli (E. coli), a type of coliform bacteria indicative of fecal contamination. Coliform bacteria are a large family of bacteria naturally present in humans, animals, and the environment and do not normally cause illness, but they should not be present in drinking water. Total coliform bacteria were detected in 29% of the domestic wells tested, a slightly lower percentage than in 2018 (31%), while E. coli was detected in 3% of the domestic wells. Total coliform and E. coli detections appear randomly distributed but are more frequent in the Llagas Subbasin.

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Figure 29. Nitrate Results for Domestic Wells Tested in 2019

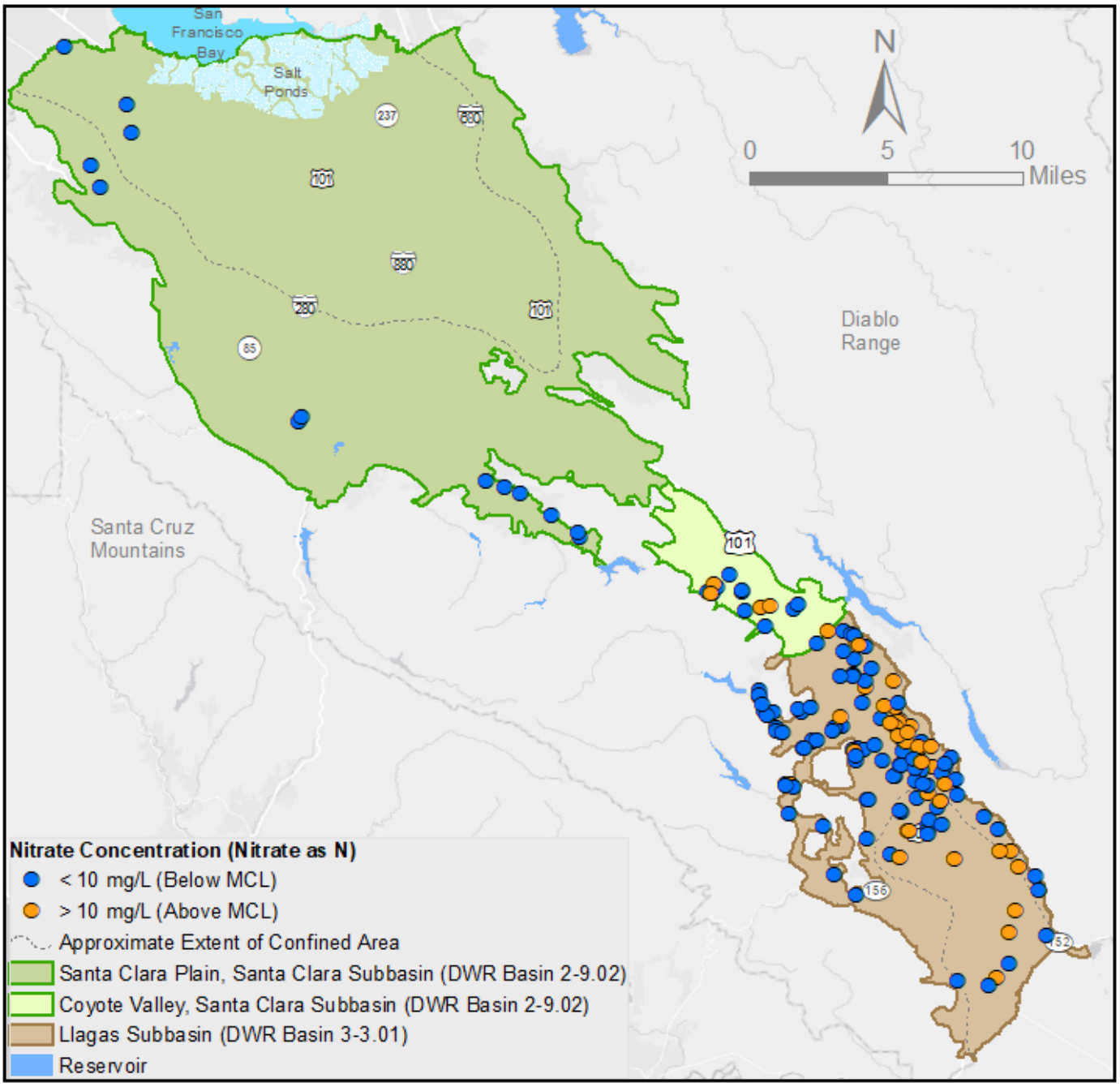

Table 9. 2019 Domestic Well Testing Results

Parameter and Units	MCL[1]	Zone W-2 North County		Zone W-5 South County	
		Median	Wells above MCL[1] (%)	Median	Wells above MCL[1] (%)
Nitrate as N (mg/L)	10 (P)	1.4	0%	6.5	29%
Fluoride (mg/L)	2 (P)	0.12	0%	0.13	0%
Sulfate (mg/L)	250 (S)	43	0%	37	0%
Total Dissolved Solids (mg/L)	500 (S)	383	21%	396	20%
Hardness (mg/L as CaCO3)	--	266	--	269	--
Bromide (mg/L)	--	0.2	--	0.19	--
Orthophosphate (mg/L as PO4)	--	<0.1	--	<0.1	--
		Wells with Bacteria Present (No.)	Wells with Bacteria Present (%)	Wells with Bacteria Present (No.)	Wells with Bacteria Present (%)
Total Coliform Bacteria	--[2]	4	33%	40	29%
E. Coli Bacteria	--[2]	0	0%	5	4%

Notes:

1. Maximum contaminant levels are established by the DDW for public water systems. (P) indicates the parameter has a health-based Primary MCL and (S) indicates a Secondary, aesthetic-based MCL. Hardness does not have a primary or secondary MCL but water with hardness above 180 mg/L is classified as very hard. Water quality in domestic wells is not regulated by the state.
2. Bacteria are measured as present or absent. Public water systems are required to ensure that fewer than 5% of samples have total coliform present and that no samples have E. Coli present.

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5.4 Recharge Water Quality

The Recharge Water Quality Monitoring Program (RMP) was developed to monitor water quality at selected groundwater recharge facilities in the Santa Clara and Llagas Subbasins. The primary objective of the RMP is to characterize recharge water quality and assess the need for changes to groundwater monitoring and/or recharge programs to ensure adequate groundwater protection.[30] Recharge facilities (percolation ponds and managed reaches of creeks) receive a combination of local runoff and imported water. The ratio of local runoff to imported water varies throughout the year and between years, depending on hydrological conditions.

Monitoring is conducted in accordance with the Valley Water's 2016 GWMP, which prescribes sampling facilities within each recharge system every three years. Recharge systems selected for monitoring are typically sampled in May, July, and September to best characterize the water quality of water used for recharge operations, which are generally implemented during the dry season (April through October). Basic water quality parameters are monitored, including major and minor inorganics, anions, nutrients, TDS, total alkalinity, and field parameters (e.g., pH, dissolved oxygen, temperature). Organic parameters (e.g. herbicides, pesticides, and disinfection byproducts) are monitored at a subset of recharge facilities that are located near potentially contaminating activities such as industrial areas and highways.

In 2019, Valley Water monitored a total of fifteen recharge facilities that comprise three recharge systems: Coyote, Los Gatos, and West Side (Figure 30, Table 10).[31]

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[30] Recharge Water Quality Monitoring Plan. September 2012. Groundwater Monitoring and Analysis Unit, Santa Clara Valley Water District.

[31] The Penitencia, Los Gatos, and Guadalupe recharge systems were scheduled to be sampled in 2019 but ponds in the Penitencia and Guadalupe system were not operated due to very healthy groundwater conditions, so West Side and Coyote were chosen for sampling instead.

Table 10. 2019 Recharge Water Quality Sampling Locations

Recharge System	Facilities Sampled in May, July, and September 2019
Coyote	• Coyote Creek: near Singleton Rd and Tuers Rd in San Jose • Coyote Creek: near Blossom Hill Rd and Hwy 101 in San Jose • Coyote Pond North: near Metcalf Rd and Old Monterey Rd in San Jose • Coyote Pond South: near Metcalf Rd and Old Monterey Rd in San Jose • Coyote Creek: near Coyote Ranch Rd and Old Monterey Rd in San Jose • Coyote Creek: near Bailey Ave and Hwy 101 in San Jose • Coyote Creek: near Barnhart Ave and Old Monterey Rd in Morgan Hill
Los Gatos	• Los Gatos Creek: near Dell Ave and Vandell Way in San Jose • Los Gatos Creek: near Dell Ave and Lost Lake Ln in San Jose • Los Gatos Creek: near Gilman Ave and E. Campbell Ave in Campbell • Los Gatos Creek: near S. Bascom Ave and E. Campbell Ave in San Jose • Los Gatos Creek: near Meridian Ave and McKinley Ave in San Jose • Los Gatos Creek: near Pedro St and Lincoln Ave in San Jose
West Side	• Stevens Creek: near Foothill Rd and I-280 in Cupertino • Stevens Creek: near Stevens Creek Blvd and Scenic Blvd in Cupertino • Stevens Creek: near McClellan Rd and Club House Ln in Cupertino

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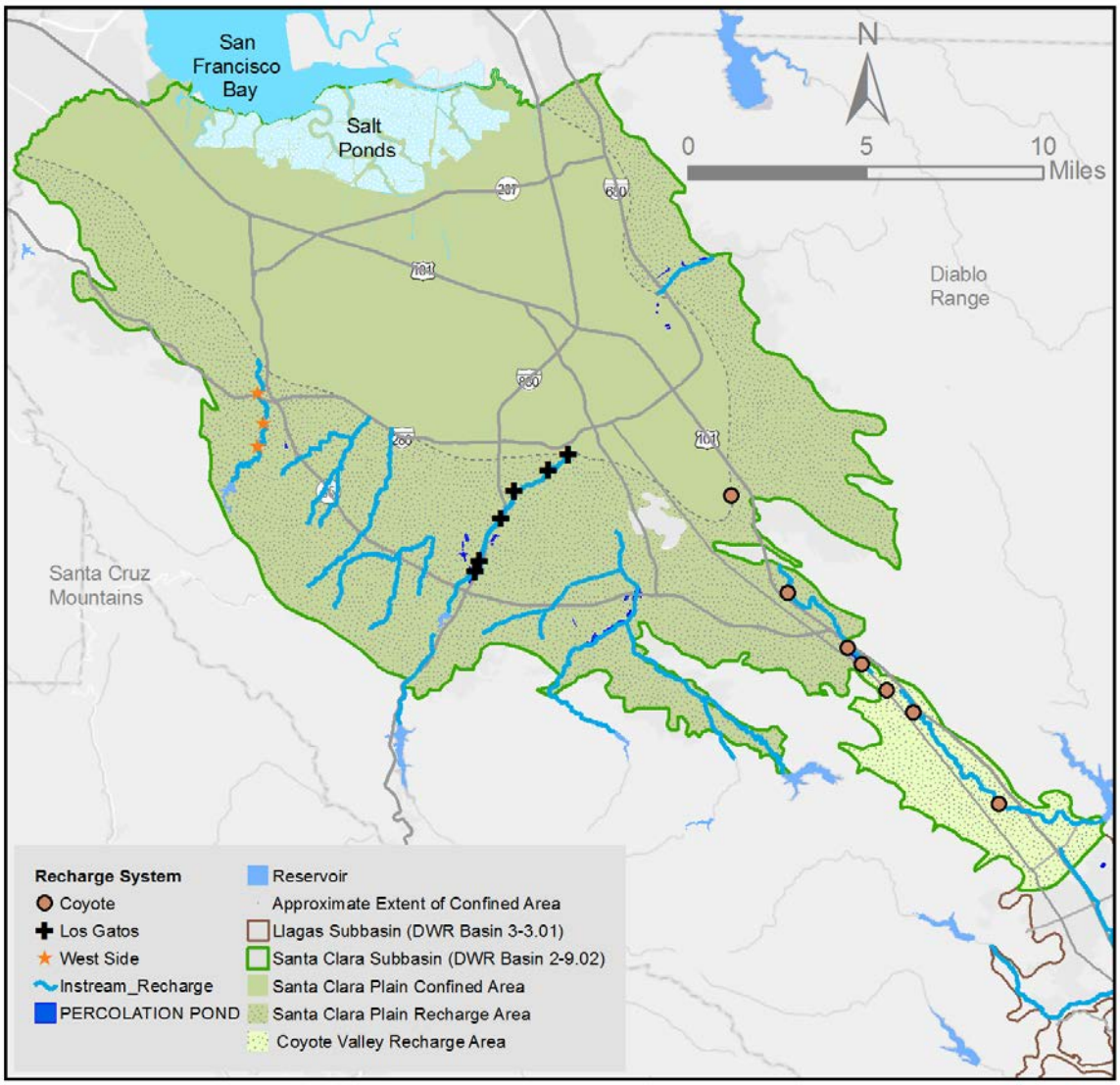
Figure 30. Location of 2019 Sampling Sites in the Coyote, Los Gatos, and West Side Recharge Systems



Although managed recharge water is not suitable for direct consumption before treatment or infiltration, comparing it to drinking water standards provides context for results. No parameters were detected above health-based water standards in any of the recharge water samples collected. Table 11 provides water quality indicators for salinity, non-point source pollution, and trace metals. Results are compared against median groundwater quality indicators for the corresponding groundwater subbasin area (Table 11). Organic parameters were not detected at any facilities in which they were monitored. In summary, recharge water quality is generally of equal or better quality than receiving water (local surface waters and groundwater) and there are no water quality concerns for the parameters tested.

Table 11. Summary of Key Water Quality Indicators for All Recharge Systems Sampled in 2019

Parameter	Units	Coyote System Median[1]	Los Gatos System Median[1]	West Side System Median[1]	MCL[2]	SMCL[2]	2019 Regional Groundwater Median[3]	
							Santa Clara Plain	Coyote Valley
Aluminum	ug/L	<20	<20	<20	1,000	200	25	20.5
Chloride	mg/L	31	11	17	N/A[6]	250	46	43
Iron	ug/L	<20	<20	<20	N/A	300	22.3	<20
Nitrate (as N)	mg/L	1.75	<0.1	0.2	10	N/A	3.1	4.2
Organics[4]	ug/L	ND[5]	ND	ND	varies	N/A	N/A	N/A
pH	pH units	7.83	8.01	7.75	N/A	6.6-8.5	7.6	7.4
Sulfate	mg/L	50.1	32.35	35.7	N/A	250	44	41.6
TDS	mg/L	320	205	324	N/A	500	410	384
Total Alkalinity (as $CaCO_3$)	mg/L	171	121	212	N/A	N/A	240	265

Notes:

1. Medians are calculated from measurements taken in May, July, and September for the stations noted in Table 11.
2. Although managed recharge water is not suitable for direct consumption before treatment or infiltration, comparing it to drinking water standards provides context for results.
3. 2019 median for principal zone of the Santa Clara Plain and Coyote Valley.
4. Organic parameters were measured using EPA Method 524.2 for Volatile Organic Compounds (VOCs) and EPA Method 525.2 for Semi-Volatile Organic Compounds (Semi-VOCs).
5. ND = non-detect (detection limits vary depending on parameter).
6. N/A = not applicable

5.5 Monitoring Near Recycled Water Irrigation Sites

Valley Water partners with the four recycled water producers[32] in Santa Clara County to provide tertiary-treated disinfected recycled water (recycled water) for non-potable purposes such as landscape irrigation, agricultural irrigation, and industrial uses. Recycled water used in Santa Clara County generally has higher concentrations of salts, nutrients, disinfection byproducts, and emerging contaminants than local groundwater or imported water.[33] Previous studies have shown that some contaminants in recycled water can migrate to shallow groundwater as a

[32] Recycled water is produced at the Palo Alto Regional Wastewater Quality Control Plant (PARWQCP), the Sunnyvale Water Pollution Control Plant (SWPCP), the San Jose/Santa Clara Regional Wastewater Facility (SJSCRWF), and the South County Regional Wastewater Authority (SCRWA). The branch of the SJSCRWF that produces recycled water is referred to as South Bay Water Recycling (SBWR).

[33] *Advanced Recycled Water Treatment Facility Project*. Black & Veatch and Kennedy/Jenks for the Santa Clara Valley Water District. August, 2003.

result of recycled water irrigation.[34,35] To ensure groundwater resources remain protected as recycled water use expands, Valley Water has monitored groundwater near areas irrigated with recycled water at the Integrated Device Technology (IDT) facility in the Santa Clara Subbasin where recycled water is provided by South Bay Water Recycling (SBWR) and monitors numerous sites in the Llagas Subbasin where recycled water is provided by the South County Regional Wastewater Authority (SCRWA). Valley Water also receives groundwater data from SBWR, which monitors groundwater near sites irrigated with recycled water in the Santa Clara Subbasin. If evidence shows that recycled water irrigation is adversely affecting groundwater, actions may be taken to mitigate the deleterious effects.

Groundwater from the four wells at the IDT facility was not monitored in 2019 due to the expiration of the monitoring agreement between Valley Water and IDT, which was developed as a mitigation measure for the use of recycled water at the site. During the ten years the IDT wells have been monitored, low levels of parameters related to recycled water have been detected but not at levels that warrant a recommendation to develop a corrective action plan or to discontinue recycled water irrigation. For example, two categories of compounds known as wastewater indicators (and contaminants of emerging concern, (CECs)), nitrosamines and Per- and Polyfluoroalkyl Substances (PFAS), have occasionally been detected at low levels in the IDT wells. Nitrosamines and PFAS are present at much higher concentrations in the recycled water delivered to the IDT facility. Results from groundwater monitoring of the IDT wells demonstrate that, in general, groundwater quality is not changing significantly over time.[36] Valley Water is exploring the possibility of continued monitoring at the IDT facility to complement groundwater monitoring data received from SBWR.

The 2019 recycled water sampling events are summarized in Table 12. More detailed monitoring results are presented in Appendix E. Geochemical evaluations and statistical analyses of long-term concentration trends are used to evaluate water quality impacts of recycled water irrigation, summarized below for the Santa Clara Plain (there is no recycled water irrigation in Coyote Valley) and the Llagas Subbasin.

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[34] *Fate and Transport of Wastewater Indicators: Results from the Ambient Groundwater and from Groundwater Directly Influenced by Wastewater*. California GAMA Program, Lawrence Livermore National Laboratory and California State Water Resources Control Board. June, 2006.

[35] *Recycled Water Irrigation and Groundwater Study: Santa Clara and Llagas Groundwater Subbasins*. Locus Technologies for Valley Water. August, 2011.

[36] *Annual Groundwater Report for Calendar Year 2018.* Valley Water. In progress.

Table 12. Summary of 2019 Groundwater Monitoring Events near Recycled Water Irrigation Sites

Subbasin	Location	Sampling Agency	Sampling Summary
Santa Clara Subbasin (Santa Clara Plain)	Various Locations in San Jose	South Bay Water Recycling (SBWR)	• Groundwater from six shallow wells and four deep wells was monitored in February 2019 by the City of San Jose per their Groundwater Mitigation and Monitoring Plan (GMMP)
Llagas Subbasin	Christmas Hill Park, Gilroy	Valley Water	• Groundwater from three shallow wells was sampled in March and September 2019 • Recycled water delivered to this site was sampled in March and September 2019
	Irrigated Land Near SCRWA Plant, Gilroy	Valley Water	• Groundwater from three shallow wells and one deep well was sampled in March and September 2019 • Recycled water delivered to the site from the SCRWA plant was sampled in March and September 2019
	Irrigated Land Along Expanded Recycled Water Pipelines (West Gilroy)	Valley Water	• Groundwater from 12 shallow monitoring wells was sampled in March 2019 and groundwater from 10 shallow wells was sampled in September 2019.

Santa Clara Subbasin

SBWR developed a Groundwater Monitoring and Mitigation Program (GMMP) in order to meet the terms of the 1997 Environmental Impact Report (EIR) for the SBWR system expansion.[37] SBWR has monitored groundwater wells in areas near recycled water irrigation since 1997. The groundwater wells monitored by SBWR consist of four (previously six; two wells were destroyed in 2018) deep groundwater supply wells and six shallow groundwater monitoring wells (Figure 31). These ten wells are referred to as "GMMP wells." The primary parameters of concern identified in the EIR were salts (measured as TDS-) and nitrate; hence, the list of monitoring parameters for the GMMP wells is less extensive than the list of monitoring parameters used by Valley Water for the IDT wells in the past and for the South County wells (described under Llagas Subbasin section). The GMMP does not include analyses for wastewater indicators such as PFAS or nitrosamines, making it more challenging to assess recycled water impacts to groundwater.

Valley Water and SBWR have worked to improve recycled water quality for irrigation and other purposes. Since March 2014, recycled water provided by SBWR has been blended with advanced treated water from Valley Water's Silicon Valley Advanced Water Purification Center, which produces up to eight million gallons of water a day. The final, blended recycled water quality is improved, with TDS lowered from about 750 mg/L to about 500 mg/L.

Concentration Trends

Concentration trend results for the deep GMMP wells show increasing trends for calcium, chloride, magnesium, and nitrate in the majority of wells (Table 13). TDS and sulfate concentrations each show increasing trends for two of the deep wells (Table 13). These concentration trend results may be due to recycled water irrigation but may also be due to other factors such as lateral movement from the recharge area into the interior of the Santa Clara Plain.

Concentration trend results for the shallow GMMP wells show increasing trends for calcium, chloride, magnesium, potassium, and sodium in the majority of wells (Table 13). These increasing concentration trends may be due to

[37] *GMMP EIR*. Harding Lawson Associates for the City of San Jose. 1997

recycled water irrigation; however, the lack of data collection of wastewater indicators makes it more difficult to determine the role recycled water irrigation plays in these trends.

Table 13. Groundwater Concentration Trends at Santa Clara Plain Recycled Water Irrigation Sites

Parameter	Number of Wells with Increasing Concentrations	Number of Wells with Stable Concentrations	Number of Wells with Decreasing Concentrations
Bicarbonate	2	5	3
Calcium	8	1	1
Chloride	7	3	0
Magnesium	8	1	1
Nitrate	4	2	4
Potassium	5	4	1
Sodium	6	2	2
Sulfate	5	2	3
Total Dissolved Solids (TDS)	5	3	2

Geochemical Analyses

Geochemical analyses were completed using Piper Diagrams, a graphical tool for understanding sources of dissolved parameters in water, water quality trends over time, and whether mixing between two water sources has occurred. Piper Diagram analysis suggests that mixing between groundwater and recycled water is not evident in samples collected from the four deep wells in 2019. Results for the six shallow GMMP wells in 2019 are inconclusive and suggest multiple geochemical processes are in progress, including the possibility of recycled water mixing with groundwater.

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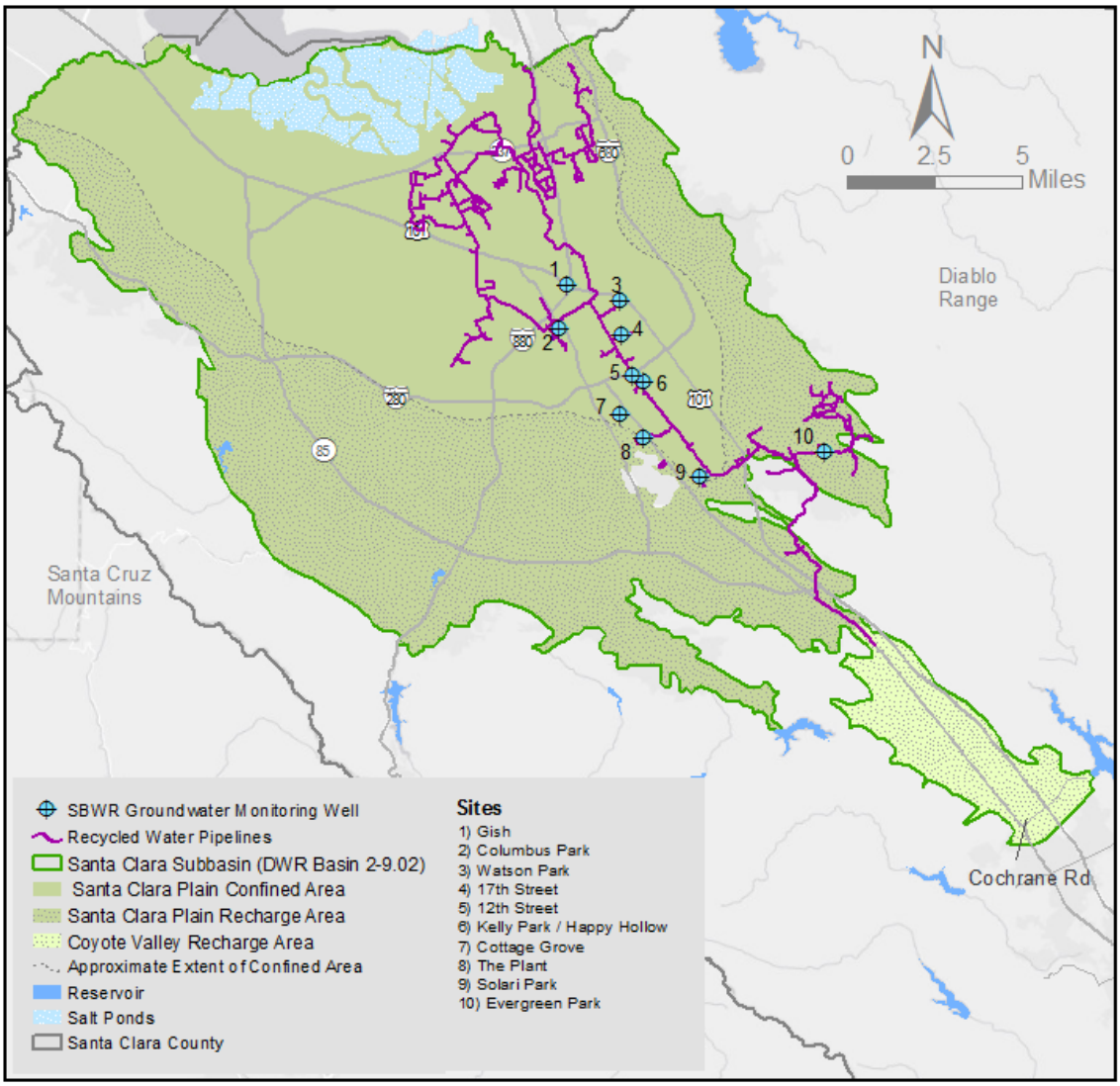
Figure 31. Groundwater Monitoring Near Santa Clara Subbasin Recycled Water Irrigation Sites



Llagas Subbasin

To support expanded recycled water use per the *South County Recycled Water Master Plan*[38] and to comply with the terms of the *Final Program EIR for the South County Recycled Water Master Plan*[39], Valley Water developed the *South Santa Clara County Recycled Water/Groundwater Monitoring Plan* (SCP) in 2012 and began collecting samples from a group of groundwater monitoring wells located along the SCRWA pipelines and at the SCRWA facility.[40] Additional groundwater monitoring wells were added to the SCP as SCRWA expanded its recycled water system; all wells monitored by Valley Water as part of the SCP are referred to as "South County wells" (Figure 32). Valley Water analyzes South County well water samples for basic water quality parameters, disinfection by-products, nitrosamines, PFAS, and other parameters commonly encountered in recycled water.

[38] *South County Recycled Water Master Plan.* Carollo Engineers for Valley Water and South County Regional Wastewater Authority. October, 2004.
[39] *Final Program EIR for the South County Recycled Water Master Plan.* Valley Water. March, 2011.
[40] *South Santa Clara County Recycled Water/Groundwater Monitoring Plan*. Valley Water. June, 2012.

Wastewater Indicators

Four of the South County wells are located near the SCRWA facility. These four wells (three shallow wells and one deep well) are near farmlands irrigated with recycled water and are also near sludge-drying ponds that receive secondary effluent produced at the SCRWA facility. Nitrosamines and PFAS have been more frequently detected, and at higher concentrations, in the four wells near the SCRWA facility than in other South County wells. This suggests an impact of recycled water, secondary effluent from the sludge-drying ponds, or both, on groundwater near the SCRWA facility.

Two PFAS measured in the South County wells, perfluorooctanoic acid (PFOA) and perfluorooctanesulfonate (PFOS), have notification levels (NLs) that have been set by the California State Water Resources Control Board at 5.1 nanograms per liter (ng/L) for PFOA and 6.5 ng/L for PFOS.[41] The NLs for PFOA and PFOS apply only to water used for drinking; while water from the South County wells is not used for drinking, the NLs provide a useful reference point with which to compare PFOA and PFOS levels. In 2019 PFOA was detected above the NL in nine South County monitoring wells, four of which are wells located at the SCRWA facility. The median value for PFOA for all South County wells is non-detect (i.e. less than 5 ng/L). However, the median value for PFOA for the nine wells in which it was detected above the NL is 12 ng/L, considerably higher than the NL for PFOA. The four monitoring wells located at the SCRWA facility have the highest levels of PFOA, ranging from 19 ng/L to 59 ng/L.

In 2019 PFOS was detected above the NL in six South County wells, four of which are wells located at the SCRWA facility. While the median value for PFOS for all South County wells is non-detect (i.e. less than 5 ng/L), the median value for PFOS for the six wells in which it was detected above the NL is 41 ng/L. This is significantly above the NL and higher than the response level (RL) of 40 ng/L. The four monitoring wells located at the SCRWA facility have the highest levels of PFOS, ranging from 17 to 96 ng/L.

While PFOA and PFOS have been consistently detected in South County and IDT wells over the years, these parameters have not been regularly measured as part of other Valley Water groundwater monitoring programs. Recently, Valley Water began a preliminary PFAS sampling program to sample up to 60 groundwater wells located throughout Santa Clara County. Data from this PFAS sampling program will allow for comparison with data gathered from the South County and IDT wells and will also provide a broader geographical view of the extent of PFAS (including PFOA and PFOS) distribution; results from the preliminary PFAS sampling program may lead to additional sampling or identify action(s) needed.

In 2019 N-Nitrosodimethylamine (NDMA) was detected in recycled water from SCRWA at levels ranging from 2.2 to 3.4 ng/L. These values are only slightly above the detection limit of 2 ng/L. NDMA was detected in three South County wells in 2019; levels ranged from 3.1 ng/L to 4.7 ng/L. For a point of reference, the NL for NDMA for drinking water is 10 ng/L. NDMA has been periodically detected at South County wells in the past.

While not specifically a recycled water or wastewater indicator, TDS values are generally higher in recycled water (and wastewater) than in local groundwater; the median TDS value for 2019 for recycled water produced by SCRWA is 729 mg/L while the regional TDS for 2019 for local groundwater from the Llagas Subbasin is 384 mg/L for the shallow aquifer and 404 mg/L for the principal aquifer. The four wells located onsite at SCRWA (plus one nearby well) have a median TDS value of 670 mg/L which is significantly higher than the median TDS value of all other South County wells, 298 mg/L. This suggests an influence of secondary effluent from the sludge-drying ponds (at SCRWA) on TDS values in nearby wells. The median TDS value of all other South County wells (of 298 mg/L) is consistent with median TDS values for the principal and shallow Llagas aquifers.

[41] State Board citation

Concentration Trends

The majority of South County wells show stable or decreasing trends for all parameters (Table 14). Chloride, potassium, and sodium have increasing trends for four, six, and five wells, respectively (Table 14). Most of the South County wells with increasing concentration trends were either located at the SCRWA facility or at Christmas Hill Park in Gilroy, which was one of the first sites to receive recycled water from SCRWA for irrigation (recycled water irrigation at Christmas Hill Park began in 2003). It is possible that these increasing concentration trends at Christmas Hill Park are due to recycled water irrigation; however, as noted below, geochemical analyses suggest that ionic composition of the three Christmas Hill Park wells is more similar to local groundwater than to recycled water.

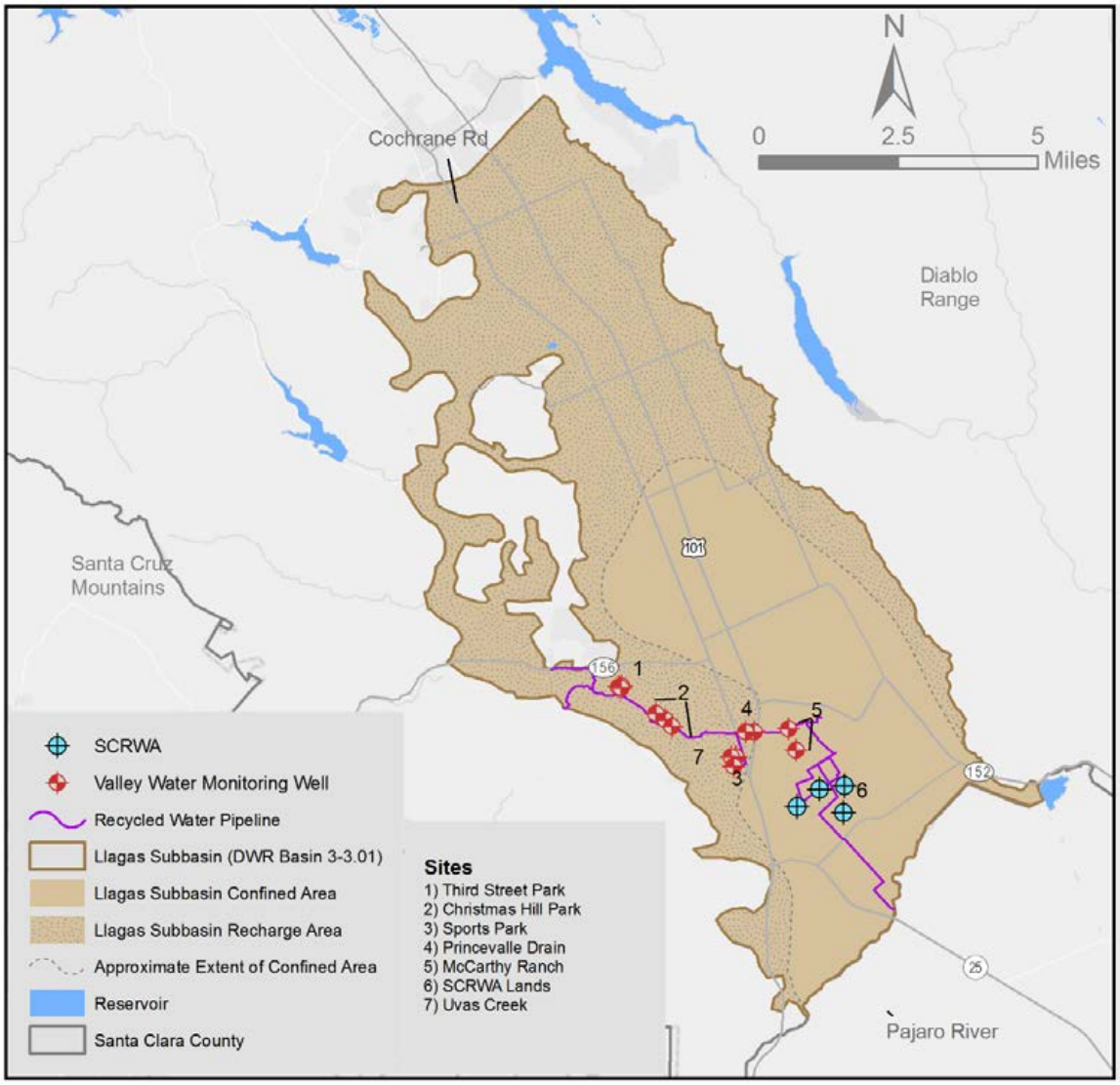
Geochemical Analyses

Geochemical analyses completed using Piper Diagrams show that the ionic composition of the three shallow wells near the SCRWA facility is almost identical to recycled water which could be due to recycled water irrigation on the nearby farmlands but could also be due to percolation of secondary effluent from the SCRWA sludge-drying ponds. Geochemical analyses of all other South County wells show ionic compositions more similar to local groundwater (than to recycled water) and do not appear to be changing significantly over time.

Table 14. Groundwater Concentration Trends at Llagas Subbasin Recycled Water Irrigation Sites

Parameter	Number of Wells with Increasing Concentrations	Number of Wells with Stable Concentrations	Number of Wells with Decreasing Concentrations
Bicarbonate	3	16	1
Bromide	1	18	1
Calcium	1	19	0
Chloride	4	15	0
Magnesium	1	19	0
Nitrate	0	20	0
N-Nitrosodimethylamine (NDBA)	0	20	0
N-Nitrosodi-n-Butylamine (NDMA)	0	20	0
Perfluorobutanoic acid (PFBA)	0	19	1
Perfluorooctanoic acid (PFOA)	0	17	3
Perfluorooctane Sulfonate (PFOS)	0	19	1
Potassium	6	14	0
Sodium	5	15	0
Sulfate	1	19	0
Total Dissolved Solids (TDS)	0	17	3

Figure 32. Groundwater Monitoring Near Llagas Subbasin Recycled Water Irrigation Sites



5.6 Salt and Nutrient Management Plans

The SWRCB's 2009 Recycled Water Policy required the development of regional Salt and Nutrient Management Plans (SNMPs) to address current and future regional salt and nutrient loading to groundwater from all sources, including recycled water and agricultural activity. Valley Water completed two SNMPs, one for the Santa Clara Subbasin and one for the Llagas Subbasin by working with local stakeholders and regulators. The plans are posted to Valley Water's website[42] and include salt and nutrient source identification, loading, assimilative capacity estimates, recycled water projections, implementation measures, groundwater monitoring provisions, and an anti-degradation analysis. The San Francisco Bay Regional Water Quality Control Board adopted resolution R2-2016-0046 approving the Santa Clara Subbasin SNMP in November 2016. The Central Coast Regional Water Quality Control Board does not plan to endorse specific SNMPs. Both agencies will use these plans to evaluate future recycled water projects.

[42] https://www.valleywater.org/your-water/where-your-water-comes-from/groundwater/groundwater-studies

The SNMPs estimate and project long-term trends in concentrations of salts (using TDS) and nutrients (using nitrate) in groundwater through the year 2035. In general, the main sources for salt loading in the Santa Clara Plain are landscape irrigation and managed recharge, followed by recycled water, whereas agricultural irrigation and managed recharge are the main contributors for the Llagas Subbasin. Table 15 compares the SNMP projections for 2019 with the median values based on groundwater samples in 2019.

Table 15. Comparison of 2019 Median Concentrations with Projected 2019 SNMP Median Concentrations

Groundwater Management Area	2019 SNMP Projected Median	2019 Actual Median	2019 SNMP Projected Median	2019 Actual Median
	TDS, in mg/L		Nitrate as N, in mg/L	
Santa Clara Plain	435	410	2.2	3.1
Coyote Valley	317	384	2.9	4.2
Llagas Subbasin, Shallow Zone	396	384	7.0	6.1
Llagas Subbasin, Principal Zone	376	404	6.4	4.7

Notes:

1. The projected medians are based on the 2019 estimates from the SNMPs. The actual medians are based on 2019 groundwater sample analysis. The Llagas Subbasin SNMP projects the median for both the northern and southern portions of the subbasin. The projected SNMP median shown in this table for each aquifer zone is the average of the north and south subbasin medians.
2. June 2016 SNMP Santa Clara Plain projected median concentrations were not evaluated for shallow and principal aquifer zones separately.

Measured median concentrations of TDS and nitrate are generally in line with SNMP projections with the exception of Coyote Valley. In Coyote Valley, measured TDS levels are higher than what was projected in the SNMP but still below the MCL of 500 mg/L. Discrepancies may be attributed to the SNMP assumptions, which attribute to a steady decrease in estimated concentrations. The SNMP assumes net removal of TDS from Coyote Valley attributed to subbasin outflow, pumping that supplies water to consumers in the Santa Clara Plain, and gaining reaches of streams within Coyote Valley. SNMP assumptions surrounding decreasing TDS concentrations in Coyote Valley will need to be further evaluated.

Both projected and actual measured medians remain below water quality thresholds established in the Regional Water Quality Control Board's Basin Plans for the Santa Clara and Llagas subbasins. As shown in Table 7 and Figures 25 and 26, regional trends for both TDS and nitrate concentrations are generally stable or decreasing in the Santa Clara Plain, Coyote Valley, and the Llagas Subbasin. Valley Water will continue to evaluate measured and projected TDS and nitrate concentrations and their relationship to hydrologic conditions to better understand the causes for fluctuations including the effects on shallow and principal groundwater aquifers.

5.7 Contaminant Release Sites

There are over 350 open cases in Santa Clara County where non-fuel contaminants have been released to soil and/or groundwater. These cases are overseen by the United States Environmental Protection Agency (EPA), California Department of Toxic Substances Control (DTSC), and the Central Coast and San Francisco Bay Regional Water Quality Control Boards (Water Boards). There are also nearly 70 open fuel leak cases overseen by the Santa Clara County Department of Environmental Health (DEH). Of these, approximately 20 are undergoing site assessment, 8 are undergoing site assessment and interim remediation, 10 are undergoing remediation, 22 are

undergoing verification monitoring, and 9 are eligible for closure. In addition, there are over 20 active Superfund sites in Santa Clara County overseen by the EPA. Although there have been very limited impacts to principal drinking water aquifers from these sites, contaminant release sites pose an ongoing threat to groundwater quality.

In 2019, 52 drinking water supply wells had low-level detections of 16 different VOCs.[43] All concentrations of these detected contaminants were below regulatory thresholds, as summarized in Appendix C, Table C-4. The increased number of wells with detected VOCs in 2019 (compared to seven in 2018) is due to a significant increase in the number of water supply wells tested for VOCs, especially PFAS, which may be attributed to increased testing directives or voluntary testing for PFAS. The interconnection between contaminant releases and drinking water supply wells underscores the importance of the ongoing work by the Water Boards, DTSC, EPA, and other regulatory agencies to ensure that contaminant release sites are properly remediated to promote water supply reliability.

Valley Water engages with the primary oversight agencies on certain contaminant release cases based on groundwater vulnerability, proximity to water supply wells or surface water, and contaminant concentration by reviewing monitoring and progress reports, regulatory orders, and correspondence submitted to regulatory agencies. Valley Water is engaged in community meetings for high-threat cases, advocates for expedited cleanup through collaboration with regulatory agencies, provides technical review of other contaminant release sites when requested by regulatory agencies, and shares groundwater data to support their work.

5.8 Well Ordinance Program

Valley Water's well ordinance program helps ensure wells and other deep excavations are properly constructed, maintained, and destroyed to prevent vertical transport of contaminants into deep drinking water aquifers. Nearly 900 permits were issued in 2019 for well construction, well destruction, and exploratory borings. Valley Water inspected over 1,200 wells and borings to ensure they were properly constructed or destroyed (Table 16).

Table 16. CY 2019 Valley Water Well Permit and Inspection Summary

Permit Type	Number Processed
Well Construction - Water Producing Wells	58
Well Construction - Monitoring Wells	313
Well Destruction	277
Exploratory Boring	231
Total	**879**
Inspection Type	**Number Inspected**
Well Construction - Water Producing Wells	56
Well Construction - Monitoring Wells	263
Well Destruction	344
Exploratory Boring	565
Total	**1,228**

[43] None of the wells with VOC detections had all compounds detected; typically, just one or a few related compounds were detected in a single well.

Groundwater Quality Outcome Measures

The evaluation of 2019 groundwater quality data relative to the GWMP outcome measures is summarized below. Additional discussion of outcome measures, including planned action to address measures not being met, is presented in Chapter 6.

OM 2.1.1.e. At least 95% of countywide water supply wells meet primary drinking water standards.
Outcome measure not met. Only 87% of countywide water supply wells tested in 2019 met all primary drinking water standards; 100% of countywide water supply wells met all primary drinking water standards when excluding nitrate exceedances. Most MCL exceedances were due to elevated nitrate levels in South County, primarily in domestic wells.

OM 2.1.1.f. At least 90% of Coyote Valley and Llagas Subbasin wells meet Basin Plan agricultural objectives.
Outcome measure met. This measure is met with 100% of all Coyote Valley and Llagas Subbasin wells meeting Basin Plan agricultural objectives in 2019.

OM 2.1.1.g. At least 90% of wells have stable or decreasing concentrations of nitrate, chloride, and total dissolved solids.

Outcome measure partially met. This measure is not met for chloride, with only 82% of wells having stable or decreasing concentrations. The measure is met for nitrate and total dissolved solids, with stable or decreasing concentrations observed in 91% and 94% of wells, respectively.

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CHAPTER 6 – GROUNDWATER MANAGEMENT PLAN IMPLEMENTATION

This chapter summarizes the status of Valley Water's Groundwater Management Plan (Plan) implementation, including outcome measure performance, recommendations, and SGMA compliance.

6.1 Outcome Measure Performance and Action Plan

The Plan identifies outcome measures to assess performance relative to Board policy and groundwater sustainability goals. The status using 2019 data is shown below, with related actions to address measures not being met.

Table 17. Summary of Outcome Measure Performance

Groundwater Storage	**OM 2.1.1.a.** Greater than 278,000 AF of projected end of year groundwater storage in the Santa Clara Plain. **Outcome measure met:** End of 2019 groundwater storage is 315,700 AF.
	OM 2.1.1.b. Greater than 5,000 AF of projected end of year groundwater storage in the Coyote Valley. **Outcome measure met:** End of 2019 groundwater storage is 12,800 AF.
	OM 2.1.1.c. Greater than 17,000 AF of projected end of year groundwater storage in the Llagas Subbasin. **Outcome measure met:** End of 2019 groundwater storage is 28,200 AF.
Groundwater Levels and Subsidence	**OM 2.1.1.d.** 100% of subsidence index wells with groundwater levels above subsidence thresholds. **Outcome measure met:** All ten wells had groundwater levels above thresholds in 2019.
Groundwater Quality	**OM 2.1.1.e.** At least 95% of countywide water supply wells meet primary drinking water standards. **Outcome measure not met:** Only 87% of wells tested in 2019 had water that met primary drinking water standards due to elevated nitrate, mainly in South County domestic wells. If nitrate is not included, 100% of water supply wells met primary drinking water standards. **OM 2.1.1.f.** At least 90% of Coyote Valley and Llagas Subbasin wells meet Basin Plan agricultural objectives. **Outcome measure met:** All wells (100%) had water quality that met agricultural objectives.
	Action Plan for OM 2.1.1.e: Implement Salt and Nutrient Management Plans to address nitrate, continue free domestic well testing and nitrate treatment system rebate programs, and continue collaborating with regulatory and land use agencies to address nitrate loading.
Groundwater Quality Trends	**OM 2.1.1.g.** At least 90% of wells have stable or decreasing concentrations of nitrate, chloride, and total dissolved solids. **Outcome measure partially met:** This measure is not met for chloride, with 82% of wells having water with stable or decreasing concentration trends. The measure is met for nitrate and total dissolved solids, with stable or decreasing concentrations observed in 91% and 94% of wells, respectively.
	Action Plan for OM 2.1.1.g: Implement Salt and Nutrient Management Plans to address salt loading, continue collaborating with regulatory and land use agencies.

As shown in Table 17, all outcome measures related to groundwater storage, levels, and land subsidence were met in 2019 due to healthy groundwater conditions that are fully recovered from the 2012-2016 drought. The rapid recovery to pre-drought conditions demonstrates the effectiveness of significant investments in diverse water supplies and conjunctive water management, as well as close coordination with water retailers.

While most wells have stable or decreasing long-term chloride, nitrate, and total dissolved solids concentration trends, some upward trends were observed and warrant further evaluation. Valley Water will assess the potential cause, continue to implement the Salt and Nutrient Management Plans, and engage with regulatory and/or land use agencies as needed.

Elevated nitrate continues to be the primary groundwater protection challenge, particularly in South County. This condition is not unique to Santa Clara County as nitrate contamination is an issue in many agricultural or rural areas throughout the state. Long-term nitrate trends in Santa Clara County indicate stable or improving conditions, which is certainly preferable to worsening conditions. However, a significant number of South County wells (primarily domestic wells) still contain nitrate above the drinking water standard. Valley Water does not control land use or have regulatory authority over activities with the most nitrate loading to groundwater, such as irrigated agriculture or septic systems. However, Valley Water continues to coordinate with land use and regulatory agencies to influence policies, regulations, and decisions related to nitrate management. More directly, Valley Water's managed recharge programs help dilute nitrate in groundwater, and water quality testing and treatment system rebates help to reduce well owner exposure.

6.2 Status of Groundwater Management Plan Recommendations

As described in the Plan and demonstrated in this report, Valley Water's proactive groundwater management programs and activities have maintained sustainable groundwater levels and storage, minimized land subsidence, and improved groundwater protection. The Plan presents six major recommendations to maintain the long-term viability of groundwater resources. A summary of the status of each recommendation is below.

1. **Maintain existing conjunctive water management programs and evaluate opportunities for enhancement or increased efficiency.**

   This Plan recommendation has several sub-recommendations, including items related to infrastructure reliability, high-priority capital project implementation, and securing imported water sources, among others. Valley Water continues to focus on extensive groundwater recharge through direct replenishment and in-lieu recharge. Updates relative to this Plan recommendation are presented below.

   Capital Projects Supporting Conjunctive Management

   Valley Water's Fiscal Year Draft 2021-25 Five-Year Capital Improvement Program (CIP) was approved for release on February 25, 2020.[44] With a significant portion of Valley Water's water supply infrastructure approaching fifty to sixty years of age, maintaining and upgrading the existing infrastructure to ensure each facility functions as intended for its useful life became the focus of the Water Supply CIP in recent years. Other CIP projects focus on expanding in-lieu and direct recharge through recycled and purified water projects. Major water supply capital improvements identified in the CIP include:

   Storage:
   - Almaden Dam Improvements
   - Anderson Dam Seismic Retrofit
   - Calero Dam Seismic Retrofit

[44] The 2021-25 CIP is available at: https://www.valleywater.org/how-we-operate/five-year-capital-improvement-program

- Guadalupe Dam Seismic Retrofit
- Pacheco Reservoir Expansion

Transmission:
- 10-Year Pipeline Rehabilitation
- Fisheries and Aquatic Habitat Collaborative Effort (FAHCE) Implementation
- Main and Madrone Pipeline Rehabilitation
- Vasona Pumping Plant Upgrade
- Almaden Valley Pipeline Replacement

Treatment:
- Penitencia Water Treatment Plant Residuals Management
- Rinconada Water Treatment Plant Reliability Improvement
- Santa Teresa Water Treatment Plant Filter Media Replacement
- Water Treatment Plant Electrical Improvement

Recycled Water:
- Expedited Purified Water Program
- South County Recycled Water Pipeline

Detailed information on each of these water supply capital projects, including related description, costs, and schedule, is available in the CIP.

2. **Continue to aggressively protect groundwater quality through Valley Water programs and collaboration with land use agencies, regulatory agencies, and basin stakeholders.**

A reliable water supply depends not only on quantity, but on quality. Sub-recommendations from the Plan include continued groundwater quality monitoring, action when potentially adverse trends are identified, and continued and enhanced collaboration with local partners and stakeholders.

Groundwater quality is typically very good in the county, with no treatment beyond disinfection required at major retailer wells. However, nitrate remains an ongoing groundwater protection challenge, particularly in the more rural Coyote Valley and Llagas Subbasin. Valley Water continues to conduct extensive groundwater quality monitoring, evaluate long-term trends, and compare current conditions against regulatory standards and projected concentrations (such as from Salt and Nutrient Management Plans).

Long-term trends are favorable for nitrate, with 91% of wells tested showing stable or decreasing concentrations. However, since a significant number of domestic wells in the Llagas Subbasin still contain nitrate above the drinking water standard, more work remains to be done. Valley Water offers rebates of up to $500 for nitrate treatment systems and will continue to engage with regulatory and land use agencies to address existing nitrate contamination. For nitrate and other water quality issues, Valley Water will work to build and enhance this collaboration to protect high-quality groundwater and expedite the restoration of impacted groundwater.

Valley Water is working with land use agencies on a Stormwater Resources Plan to increase infiltration while ensuring pollutants from urban runoff are not merely transmitted from surface water to groundwater. Similarly, Valley Water continues to engage with various entities to ensure that recycled water expansion or the use of purified water for recharge will be protective of groundwater quality.

Engaging with land use and regulatory agencies on proposed policy, legislation, and projects that may impact groundwater remains a key strategy for protecting groundwater. For example, Valley Water tracks the progress

of major contaminant release sites, interacting with regulatory agencies to promote expedited and thorough cleanup. Valley Water also engages with land use agencies on relevant projects and policies such as development, stormwater infiltration devices, septic systems, and small water systems.

Public outreach continues to be an important component of Valley Water's groundwater protection efforts. Valley Water annually celebrates Groundwater Awareness Week by highlighting groundwater on the Valley Water website and posting related social media messages. Valley Water also maintained its status as a Groundwater Guardian through a program sponsored by the non-profit Groundwater Foundation. This is an annually earned designation for communities and affiliates that take voluntary, proactive steps toward groundwater protection.

To provide information on well sampling by Valley Water and local water suppliers, Valley Water prepared the 2019 Groundwater Quality Summary. This is similar to water retailer consumer confidence reports and provides basic groundwater quality information to domestic well owners who do not typically receive water from a water retailer.

Other groundwater-related public outreach conducted by Valley Water in 2019 included:

- Interaction with thousands of students through the Education Outreach program.
- Direct communication with well owners on groundwater quality, well maintenance, and treatment systems under the Domestic Well Testing and Nitrate Treatment System Rebate programs.

3. Continue to incorporate groundwater sustainability planning in Valley Water planning efforts.

This Plan recommendation focuses on continued, thoughtful water supply planning and investments. In November 2019, Valley Water completed an update to the Water Supply Master Plan 2040[45], which explains Valley Water's strategy for providing a reliable and sustainable water supply into the future. The Water Supply Master Plan 2040 informs investment decisions and provides a framework for annually monitoring the water supply strategy to ensure it will meet the water needs of Santa Clara County. Staff held multiple workshops with water retailers and stakeholders and presented information to the Board and the Board's Water Conservation and Demand Management Committee on numerous occasions. These presentations have included information on the proposed level of service goal and potential water supply investment strategies. The Valley Water investment strategy includes securing existing supplies, expanding water conservation and reuse, and optimizing the system. Projects approved by the Board for planning include advanced metering infrastructure, leak repair incentives, expansion of Valley Water's graywater program, a model water-efficient ordinance for new developments, decentralized stormwater capture (e.g., incentives for rain barrels, cisterns, and rain gardens), and centralized stormwater capture (e.g., flooding of agricultural lands), 24 thousand acre-feet of potable reuse, the Delta Conveyance Project, expanding Pacheco Reservoir, and the Transfer-Bethany Pipeline. Details about each of these projects can be found in Appendix H of the Water Supply Master Plan 2040.

Groundwater sustainability also remains an important factor during the planning and implementation of multi-benefit projects under Valley Water's One Water Plan.[46] The Sustainable Groundwater and Water Quality objectives of the One Water Plan align with the Plan outcome measures and the process to identify individual projects on the watershed scale (e.g., Coyote Watershed) accounts for groundwater conditions and sustainability.

To support managed response to climate change, Valley Water is developing a Climate Change Action Plan (CCAP) that will be completed in 2020. The CCAP will include comprehensive review of climate change as it

[45] Santa Clara Valley Water District, Water Supply Master Plan 2040 is available at: https://www.valleywater.org/sites/default/files/Water%20Supply%20Master%20Plan%202040_11.01.2019_v2.pdf
[46] https://onewaterplan.wordpress.com/

relates to Valley Water core services and include goals, strategies, and possible actions to respond to climate change. The CCAP will identify potential future climate change vulnerabilities and risks to all core service areas, including water supply and groundwater management. The CCAP will provide goals and strategies to reduce risks to Valley Water core services and its mission. The strategies will be incorporated into existing Valley Water plans, budgets, and long-term financial forecasts as appropriate.

4. **Maintain adequate monitoring programs and modeling tools.**

This Plan recommendation focuses on improving monitoring networks by identifying and addressing gaps, redundancies, and access issues; identifying and implementing improvements to the numerical groundwater flow models; and improving Valley Water's understanding of surface water/groundwater interaction and groundwater dependent ecosystems (GDEs).

Valley Water continues to offer free basic well testing for domestic well owners to supplement regional groundwater quality monitoring, which emphasizes the use of consistent wells. Through this voluntary program, Valley Water obtains valuable data on nitrate and other contaminants while providing important water quality data to about 200 private well owners each year. Valley Water is evaluating the recycled water and recharge water quality monitoring networks to ensure they meet monitoring objectives in terms of frequency, locations, and constituents analyzed. Monthly Water Tracker[47] and groundwater condition reports[48] help keep stakeholders informed about current groundwater conditions including groundwater pumping, recharge, and water levels.

Valley Water uses three calibrated groundwater flow models – one for each groundwater management area (Santa Clara Plain, Coyote Valley, and the Llagas Subbasin). These models are used to evaluate groundwater storage and levels to inform operational decisions and long-term planning efforts. Staff is assessing each model to identify related improvements or enhancements that may be needed or desired to improve the use of these tools.

Regarding surface water/groundwater interaction, Valley Water staff has begun to evaluate available data for stream gauging and groundwater levels, and whether existing wells adjacent to creeks may be useful in collecting additional data. Staff has attended workshops organized by DWR and reviewed both relevant literature and how other Groundwater Sustainability Agencies (GSAs) are working to better understand groundwater-surface water interaction. Staff has also performed preliminary experiments to measure the flux between surface water and groundwater. Valley Water will continue to explore the complex and dynamic interaction between surface water and groundwater and will engage interested stakeholders. This issue will be further documented in the five-year Groundwater Management Plan update, which is due by January 1, 2022.

5. **Continue and enhance groundwater management partnerships with water retailers and land use agencies.**

This Plan recommendation focuses on continued collaboration and strong partnerships with water retailers and land use agencies. Valley Water continues to interact regularly with water retailers through quarterly Water Retailer meetings, including the Groundwater Subcommittee. In addition to these regular meetings, Valley Water and water retailers collaborate on various issues that arise regarding groundwater, treated water, wells, and water measurement.

Valley Water also continues to coordinate with local land use agencies on General Plans, water supply assessments, Urban Water Management Plans, stormwater management, and various individual land use projects. Land use decisions fall under the authority of the local cities and the County of Santa Clara. Valley

[47] https://www.valleywater.org/your-water/water-supply-planning/monthly-water-tracker
[48] https://www.valleywater.org/your-water/where-your-water-comes-from/groundwater/groundwater-monitoring

Water reviews land use and development plans related to Valley Water facilities and watercourses under Valley Water jurisdiction and provides technical review for other land use proposals as requested by the local agency. When provided by land use agencies, water supply assessments for new developments are also reviewed and evaluated in the context of Valley Water's long-term water supply plans. For all reviews, Valley Water's groundwater-related comments focus on potential impacts to groundwater quality and sustainability.

6. **Evaluate the potential new authorities provided by SGMA.**

The Santa Clara Valley Water District Act provides broad authorities, but there are additional authorities under SGMA including the ability to regulate pumping or impose various types of fees. This Plan recommendation focused on the evaluation of these new SGMA authorities in cooperation with water retailers and other interested stakeholders to consider what conditions might necessitate their implementation to sustainably manage groundwater into the future.

As first described in the WY 2017 Annual SGMA Report submitted to DWR, Valley Water has explored new SGMA authorities with interested stakeholders through the Board's Water Conservation and Demand Management Committee (Committee). Nine publicly noticed Committee meetings between December 2016 and December 2017 provided a transparent forum for discussion with interested stakeholders on how and when these authorities might be used.

The potential regulation of pumping or well construction is a complex and controversial topic, which was discussed extensively through Committee meetings. Existing groundwater management programs and strong partnerships with large pumpers are expected to result in continued sustainable conditions and are the preferred way to address future challenges. However, pumping regulation may be needed in the future to address undesirable results. The primary SGMA-related work product from the Committee meetings was a process that describes the fundamental approach to respond to potential worsening basin conditions. This includes the steps that would be taken prior to implementing SGMA authorities to regulate groundwater pumping, with a focus on providing some certainty on the process, while avoiding prescriptive requirements that may not be effective in addressing a future issue. This process was memorialized via a resolution adopted by Valley Water Board on February 27, 2018. This resolution was included as Attachment 2 in the WY 2018 Annual SGMA report to DWR.

Valley Water also explored the potential to implement a fixed charge as a component of groundwater production charges, which are currently volumetric charges. This could potentially reduce volatility in rates and revenues based on changes in water use. Valley Water engaged a consultant to develop a fixed charge proposal and assist with implementation. However, major water retailers expressed significant concerns, including redundancy with other charges or charge adjustment mechanisms, equity in applying the charge to all well users, and potential cost recovery impacts to retailers regulated by the California Public Utilities Commission. After discussing these concerns with the Committee and the full Board, Valley Water is unlikely to further pursue a fixed charge at this time.

6.3 Status of Sustainable Groundwater Management Act Compliance

In December 2016, Valley Water submitted the Plan (for the Santa Clara and Llagas Subbasins) to DWR as an Alternative to a Groundwater Sustainability Plan (GSP). In July 2019, DWR issued an assessment, finding the Valley Water Plan satisfies the objectives of SGMA and is an acceptable Alternative. Valley Water will be required to submit an updated Plan every five years, with the next Plan due by January 1, 2022.

Once an Alternative or GSP is submitted, SGMA requires that specific information on groundwater use, levels, and storage be reported annually by April 1 for the previous water year. In April 2020, Valley Water submitted the third annual report required by SGMA (Appendix F). Because most Valley Water planning efforts are based on the

calendar year, this Annual Groundwater Report presents some of the same information based on the calendar year. It also provides more detailed information on groundwater conditions, particularly regarding groundwater quality.

Valley Water is also the GSA for the small portions of the North San Benito Subbasin within Santa Clara County.[49] As such, staff is supporting efforts led by the San Benito County Water District[50] to develop a GSP by the statutory deadline of January 2022. This includes serving on the Technical Advisory Committee, sharing relevant data, and other coordination as needed.

Continued groundwater sustainability is central to the Valley Water mission to provide Silicon Valley safe, clean water for a healthy life, environment, and economy. As such, Valley Water will continue to "aggressively protect groundwater from the threat of contamination and maintain and develop groundwater to optimize reliability and to minimize land subsidence and salt water intrusion," in accordance with Board policy. Valley Water's approach to groundwater management has evolved over many decades to address numerous challenges, and this adaptive approach will help ensure continued sustainability.

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[49] A basin boundary modification was approved by DWR in 2019 to consolidate four subbasins primarily located in San Benito County. These include the Hollister and San Juan Bautista Area subbasins, which extend into Santa Clara County.
[50] The GSA for the portions of the North San Benito Subbasin located in San Benito County.

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APPENDIX A
2019 Subsidence Data Analysis

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TECHNICAL MEMORANDUM

2019 SUBSIDENCE DATA ANALYSIS

Prepared by:

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Under the Direction of:

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Santa Clara Valley Water District
Groundwater Management Unit

March 2020

EXECUTIVE SUMMARY

This technical memo presents land subsidence data analysis for calendar year 2019. Throughout the first two thirds of the 20th Century, land subsidence occurred in the Santa Clara Plain in northern Santa Clara County mainly due to groundwater overdraft causing declining groundwater elevations and pressures. Permanent (inelastic) subsidence was essentially halted in the early 1970s through Valley Water's conjunctive management programs and investments (Valley Water, 2019). Monitoring continues and is critical to fulfilling Valley Water's mission of minimizing land subsidence and saltwater intrusion (Board Ends Policy 2.1.1). Monitoring provides data to evaluate current conditions and for early detection of the potential resumption of permanent subsidence. Annually, Valley Water analyzes land subsidence monitoring data, evaluates subsidence conditions, and recommends improvements to the subsidence monitoring network. Data collected mainly from 2009 to 2019 is used in this analysis.

2019 annual precipitation was 16.11 inches (NOAA San Jose Station: GHCND:USW00023293), in comparison to the average annual precipitation of 14.50 inches in the Santa Clara Plain. The annual estimated groundwater pumping in 2019 was 57,700 acre-feet (AF). 2019 total estimated groundwater recharge was 71,400 AF, of which 42,000 AF was managed recharge and 29,400 AF was natural recharge. Since total recharge exceeded pumping, the overall groundwater storage increased in the Santa Clara Plain in 2019.

The data measured in 2019 through the Valley Water's subsidence monitoring network show the following:

- 2019 annual average of groundwater elevations were near historically high levels. The groundwater elevations were above subsidence thresholds at all ten index wells for the entire year.
- Aquifer expansion (uplift) was measured at the Valley Water's two extensometer sites in 2019. The average annual subsidence rate over the last 11 years (2009-2019) at the San Jose (Martha) and Sunnyvale (Sunny) sites is -0.006 feet/year (aquifer expansion), which meets the Valley Water's established tolerable subsidence rate of not more than 0.01 feet/year.
- Between 2018 and 2019, the average land surface elevation change was close to zero at all survey benchmarks, indicating little land elevation change in 2019. Over the last 11 years (2009-2019), the average annual change in land surface elevations was slightly greater than zero (uplift) at all survey benchmarks.

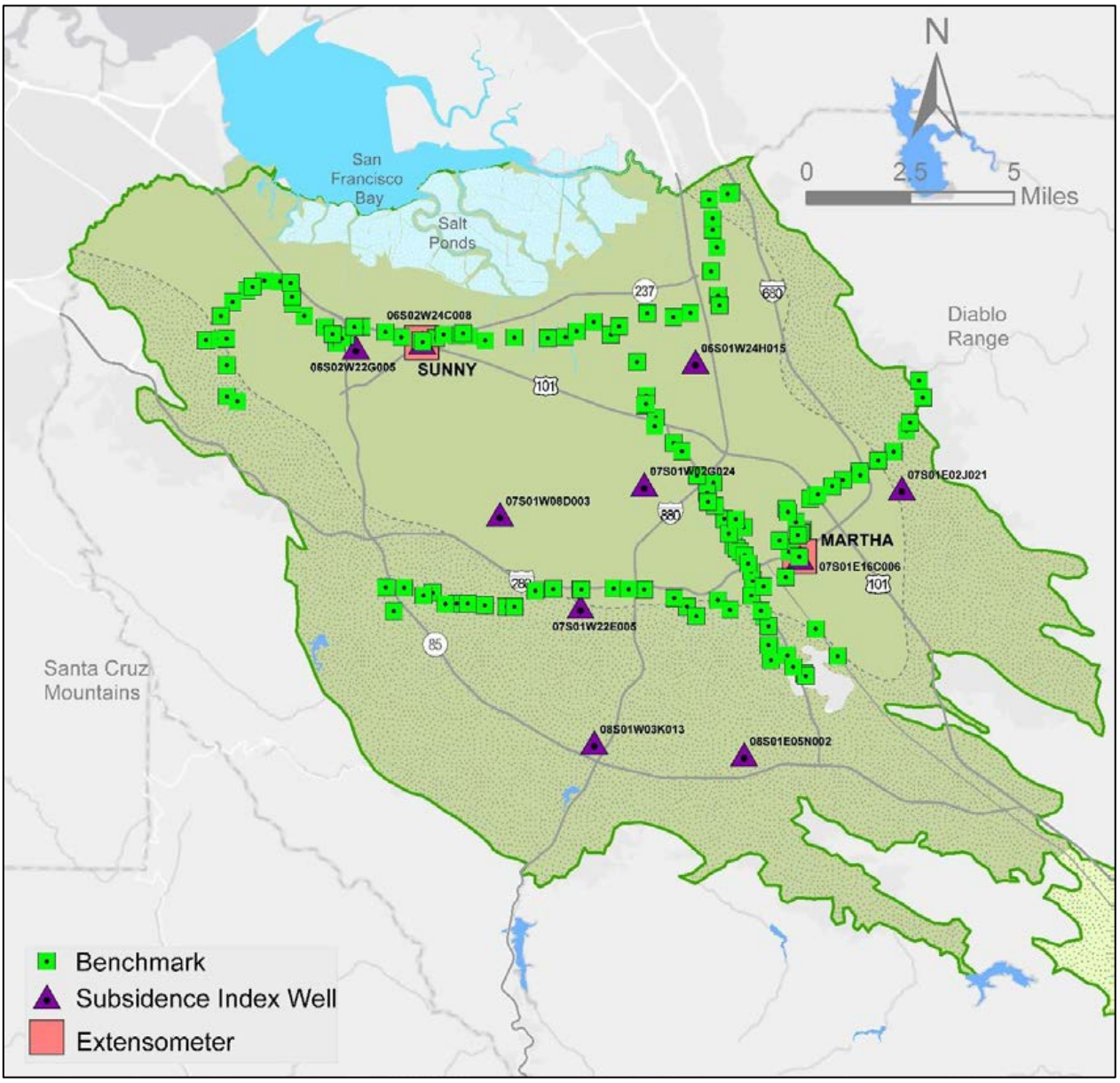
The analysis of the data collected through Valley Water's subsidence monitoring network indicates that the risk of land subsidence in 2019 was very low and similar to or less than 2018. Monitoring of the subsidence network will continue as it is needed to detect early signs of permanent land subsidence and to ensure a sustainable groundwater supply.

BACKGROUND

The Santa Clara Plain is a groundwater management area occupying the northwestern and largest part of the Santa Clara Subbasin. The Santa Clara Plain extends from Santa Clara County's northern boundary to approximately Metcalf Road in the Coyote Valley and is bounded on the west by the Santa Cruz Mountains and the east by the Diablo Range (Figure 1). Land subsidence has caused serious problems in the Santa Clara Plain prior to about the 1970s, including nearly 13 feet of permanent subsidence in

downtown San Jose and more than a foot of permanent subsidence over the surrounding hundred square miles.

Figure 1. Valley Water subsidence monitoring network.



Ongoing monitoring provides data for current land subsidence evaluation and early detection of potential permanent subsidence. The Valley Water land subsidence monitoring network (Figure 1) includes:

- Two extensometers: one in Sunnyvale (Sunny) and one in San Jose (Martha), both are monitored continuously by telemetry systems;
- Approximately 140 elevation benchmarks along three Cross Valley Level Circuits (CVLCs) are surveyed in the fall of every year; and

- Ten subsidence index wells with groundwater elevations monitored at least monthly, including two subsidence index wells that are located at the Sunny and Martha extensometer sites.

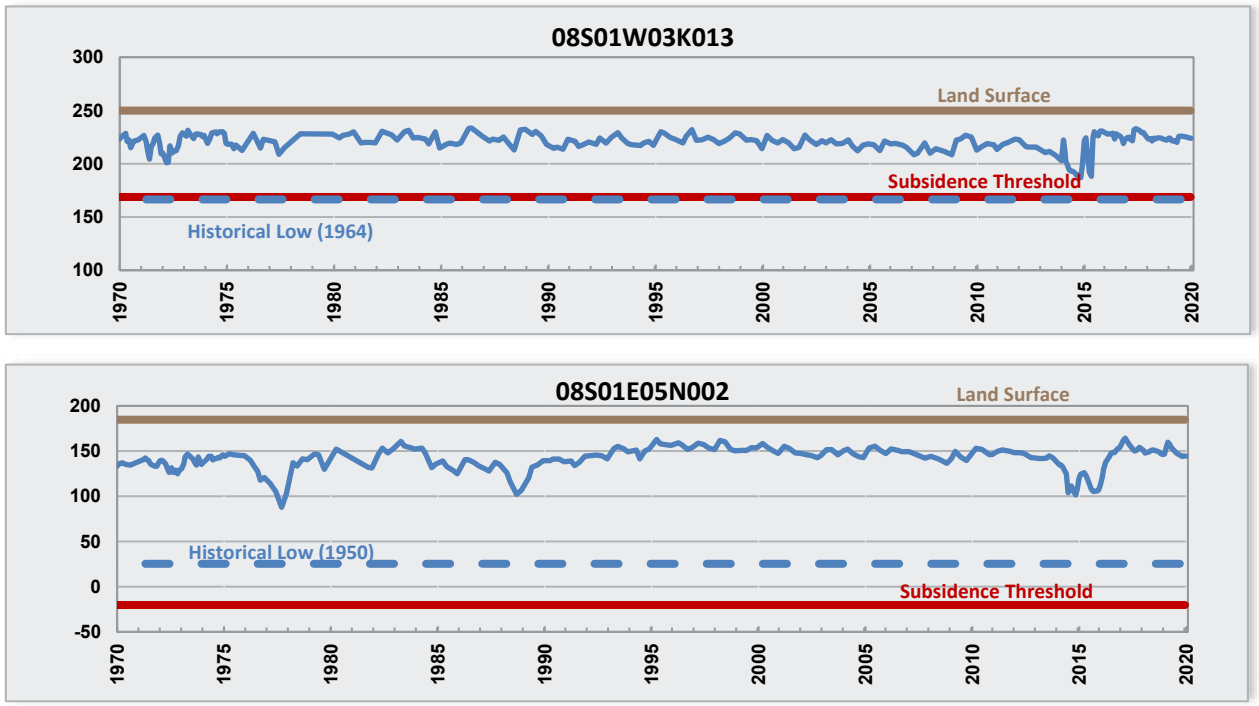
EVALUATION

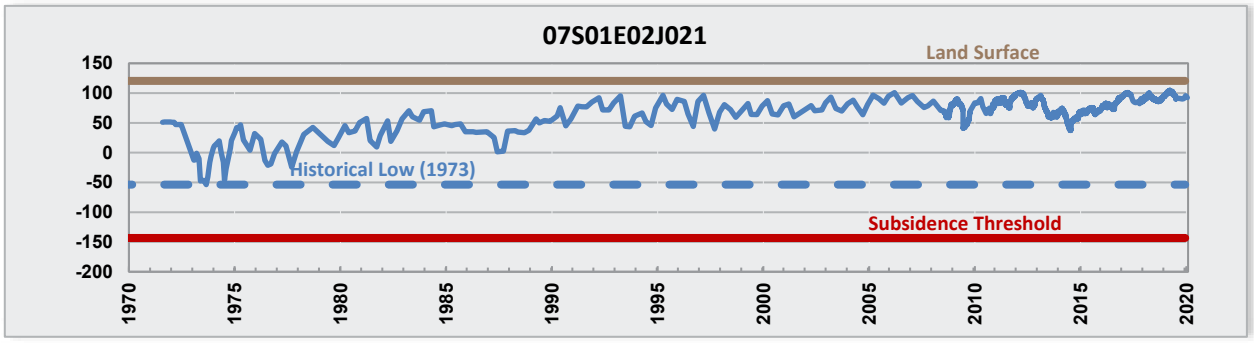
Figure 1 shows a map of the Valley Water subsidence monitoring network in the Santa Clara Plain. Two extensometers are in the confined area of the Santa Clara Plain. Benchmarks are grouped into three CVLCs: Guadalupe (northwest-trending circuit along the axis of the valley), Los Altos (west-east trending circuit to the north), and Alum Rock circuit (west-east trending circuit to the south). The ten subsidence index wells are located throughout the Santa Clara Plain.

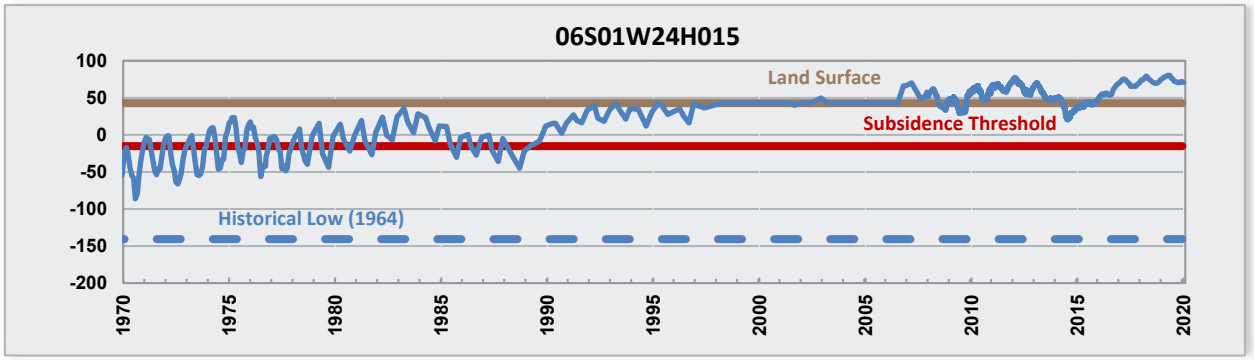
Groundwater elevation analysis

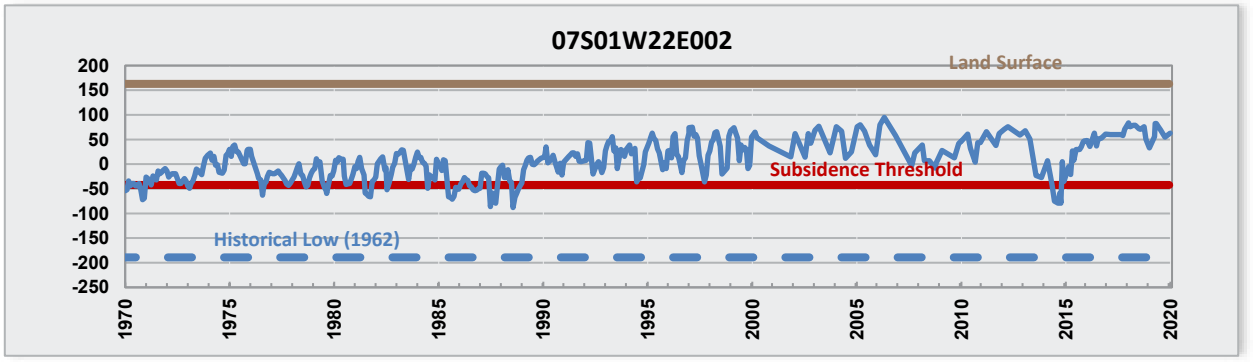
Groundwater elevation monitoring is an integral part of the land subsidence monitoring program since the decrease in water elevation is the driving force of land subsidence in the Santa Clara Plain. The current frequency of groundwater elevation monitoring at subsidence index wells varies from daily to monthly. Water elevation hydrographs at the ten index wells are presented in Figure 2, along with land surface elevations, historical low water levels, and subsidence groundwater elevation thresholds determined for each well (GEOSCIENCE, 1991). The North American Vertical Datum of 1988 (NAVD88) is used for the groundwater elevation values in this document.

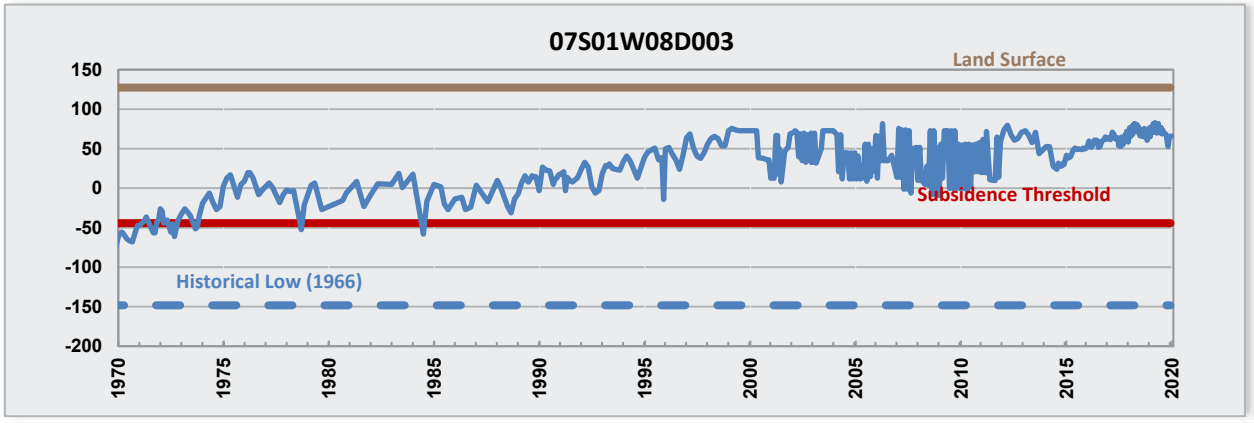
Figure 2. Measured groundwater elevation at subsidence index wells (Feet, NAVD88)

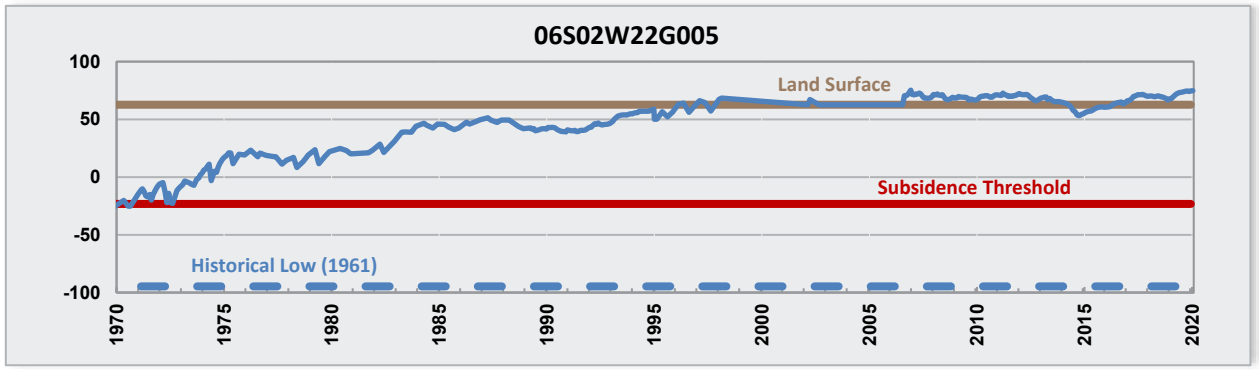


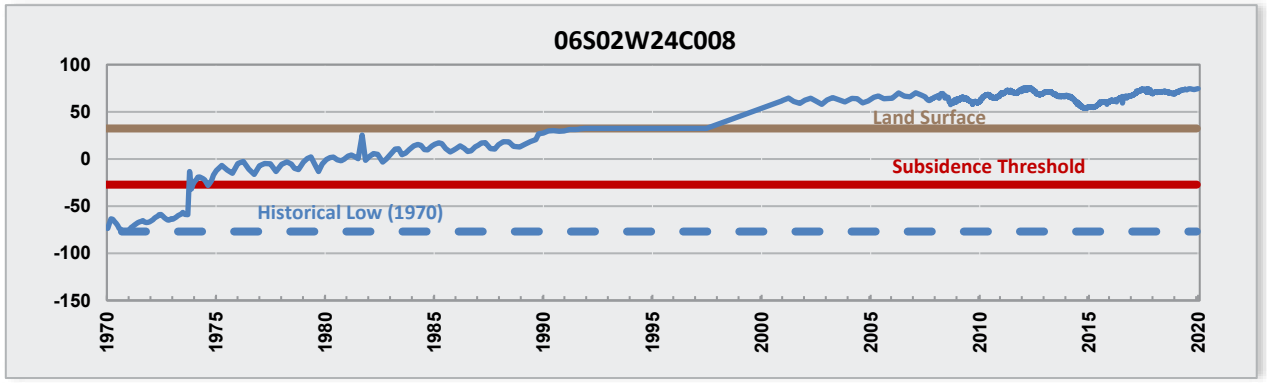

07S01E02J021
Land Surface
Historical Low (1973)
Subsidence Threshold
150
100
50
0
-50
-100
-150
-200
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020

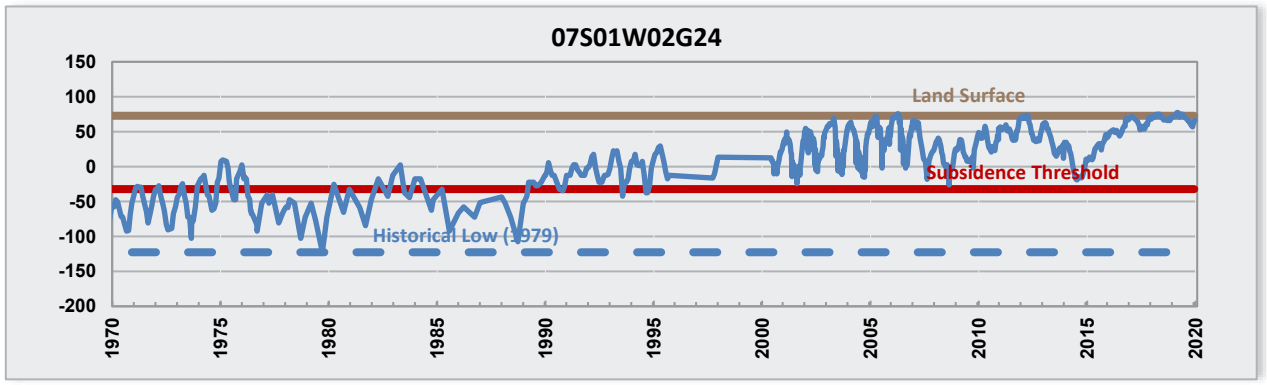

06S01W24H015
Land Surface
Subsidence Threshold
Historical Low (1964)
100
50
0
-50
-100
-150
-200
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020

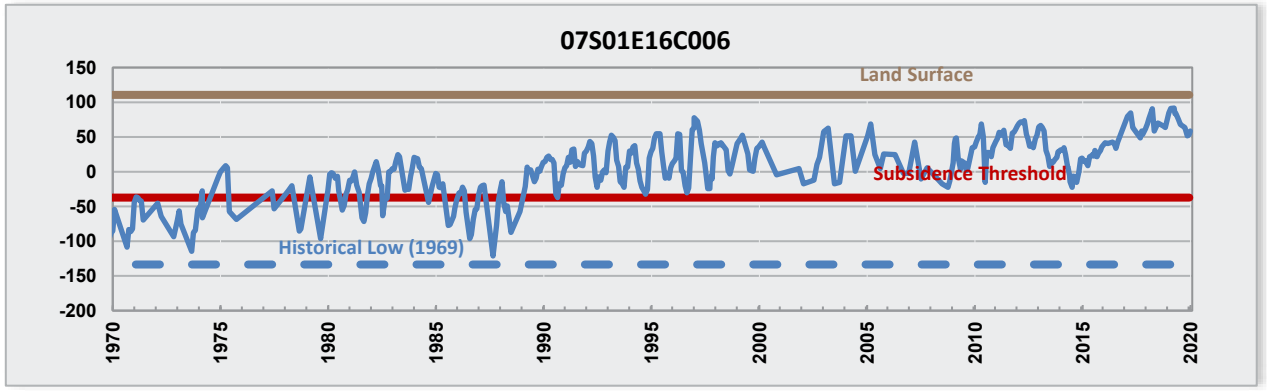

07S01W22E002
Land Surface
Subsidence Threshold
Historical Low (1962)
200
150
100
50
0
-50
-100
-150
-200
-250
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020


07S01W08D003
Land Surface
Subsidence Threshold
Historical Low (1966)
150
100
50
0
-50
-100
-150
-200
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020


06S02W22G005
Land Surface
Subsidence Threshold
Historical Low (1961)
100
50
0
-50
-100
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020


06S02W24C008
Land Surface
Subsidence Threshold
Historical Low (1970)
100
50
0
-50
-100
-150
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020


07S01W02G24
Land Surface
Subsidence Threshold
Historical Low (1979)
150
100
50
0
-50
-100
-150
-200
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020


07S01E16C006
Land Surface
Subsidence Threshold
Historical Low (1969)
150
100
50
0
-50
-100
-150
-200
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020

A subsidence threshold is a recommended groundwater elevation; maintaining groundwater at elevations near or below the threshold for extended periods of time increases the risk of subsidence resumption and potential damage to facilities and infrastructures. Historically, land subsidence was observed mainly in the confined area of the Santa Clara Plain. Accordingly, most index wells (eight out of ten) are in or near the confined area. Valley Water's groundwater management goal is to maintain groundwater elevations in the Santa Clara Plain above subsidence thresholds to minimize the risk of resuming permanent land subsidence.

Historical low groundwater elevations at most wells in Santa Clara Plain were observed in the 1960s and 1970s. Since then, the groundwater elevations have been generally in recovery due to the importation of surface water from the Delta and related increased managed recharge and/or reduced groundwater pumping. Due to drought conditions, groundwater elevations in the Santa Clara Plain had been generally declining starting in 2012 and reached recent low water elevations in 2014. During this period, groundwater elevations at three subsidence index wells (well numbers 07S01W22E002, 07S01E16C006, and 07S01W02G024) were close to or below subsidence thresholds and thus increased the risk of land subsidence.

The annual precipitation from 2016 to 2019 was close to or above the normal after a four-year drought (from 2012 to 2015). The average groundwater elevations rose in 2016 and 2017 and remained high in 2018 and 2019 at all subsidence index wells (Figure 2). Groundwater elevations at the end of 2019 were well above subsidence thresholds. The main drivers of the water elevation recovery from 2016 to 2019 were the reduced pumping and increased recharge. The total recharge amount, including the managed recharge and natural recharge, was about 1.5 times the pumping on a four-year average for 2016 to 2019. This resulted in the water elevations at end of 2019 being 19 to 144 feet higher than the lowest water elevations in 2014 in subsidence index wells.

It is critical to manage the groundwater basin in a manner that maintains a groundwater gradient towards the San Francisco Bay to keep saltwater from entering the groundwater aquifer. There are three index wells along the bay front: 06S02W22G005, 06S02W24C008 and 06S01W24H015. Beginning in 2012, groundwater elevations in those three wells declined consistently, reaching their recent low elevations in 2014. As described above, a substantial water elevation recovery was observed since 2014. By the end of 2019, all three bay front index wells were flowing artesian, which reduces the risk of saltwater intrusion.

In summary, groundwater elevations measured at subsidence index wells were maintained well above subsidence thresholds throughout 2019. Measured groundwater elevations indicate that the risk of both land subsidence resumption and saltwater intrusion was minimal in 2019 and was substantially reduced as compared to 2014.

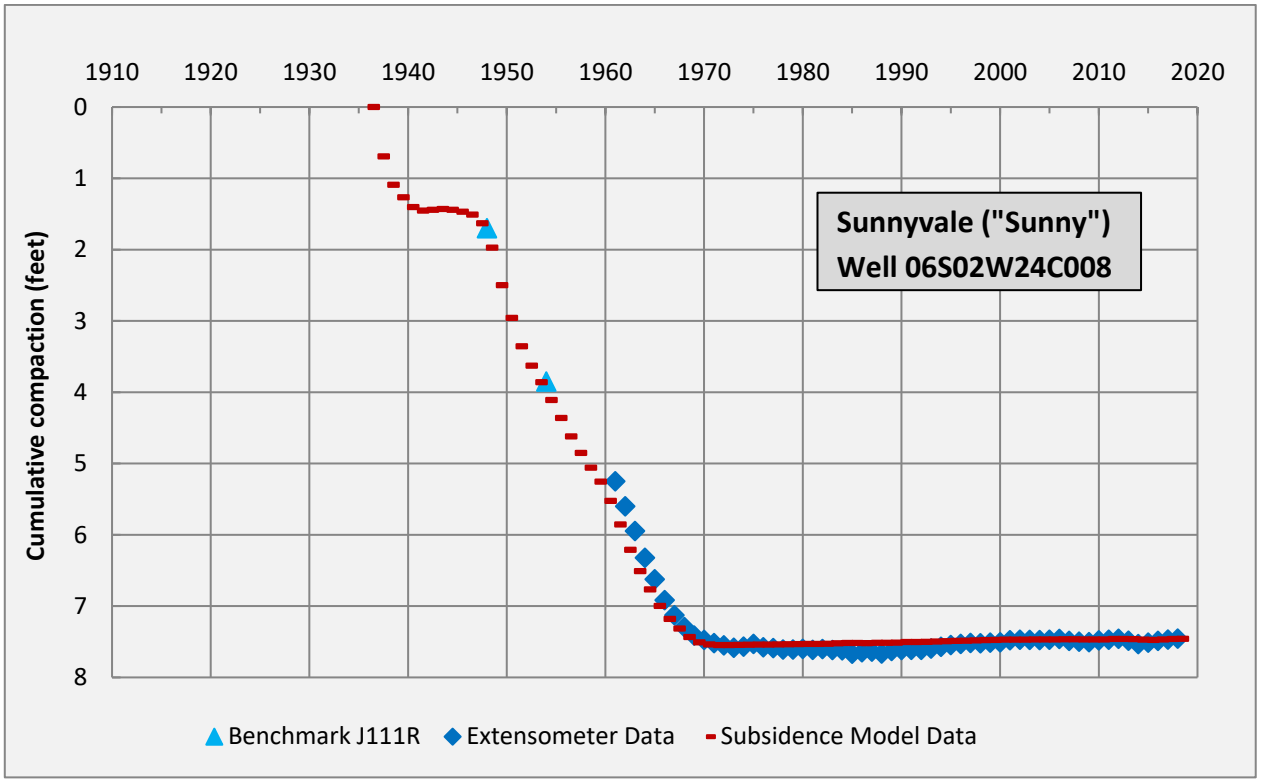
Extensometer data analysis

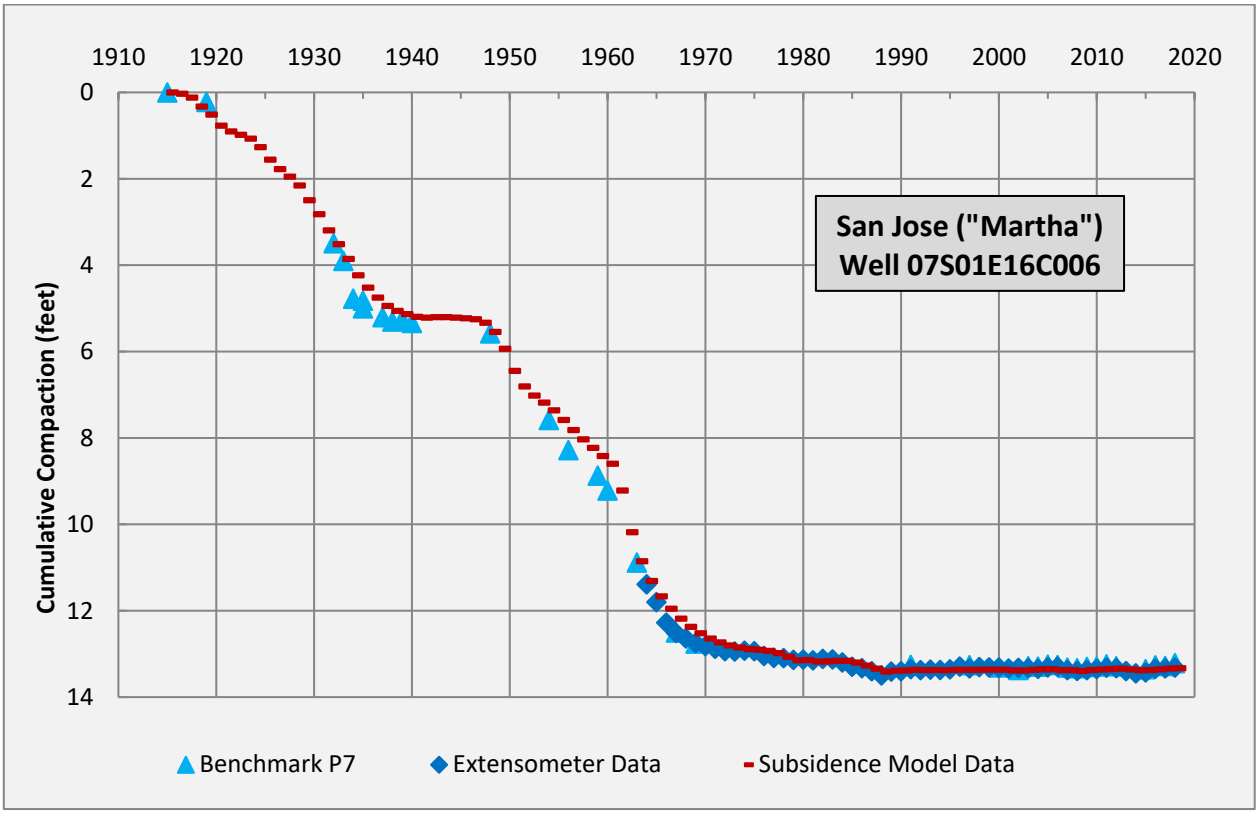
Daily aquifer compaction/expansion data measured at two extensometers and depth to water (DTW) measured at or near the extensometers were used for this analysis. An extensometer is a device used to continuously monitor aquifer compaction (subsidence) and expansion (uplift). The extensometers were installed in the early 1960s in Sunnyvale (Sunny) and San Jose (Martha) to measure the compaction or expansion of the first 1,000 feet of the aquifer system. The extensometer sites were selected in areas with high land subsidence between the 1930s and 1960s. These areas were also pumping centers during

that period. Valley Water's goal for the average value of subsidence measured at these two sites over the last 11 years is not to exceed a tolerable subsidence rate of 0.01 feet/year (GEOSCIENCE, 1991).

Long- term data: Figure 3 shows cumulative compaction measured at the extensometers for the period of record supplemented with nearby benchmark data. Land subsidence occurred mostly prior to 1970 and has been negligible over the last several decades (Figure 3). There is close correlation between Valley Water's land subsidence model (PRESS model) output and observed compaction.

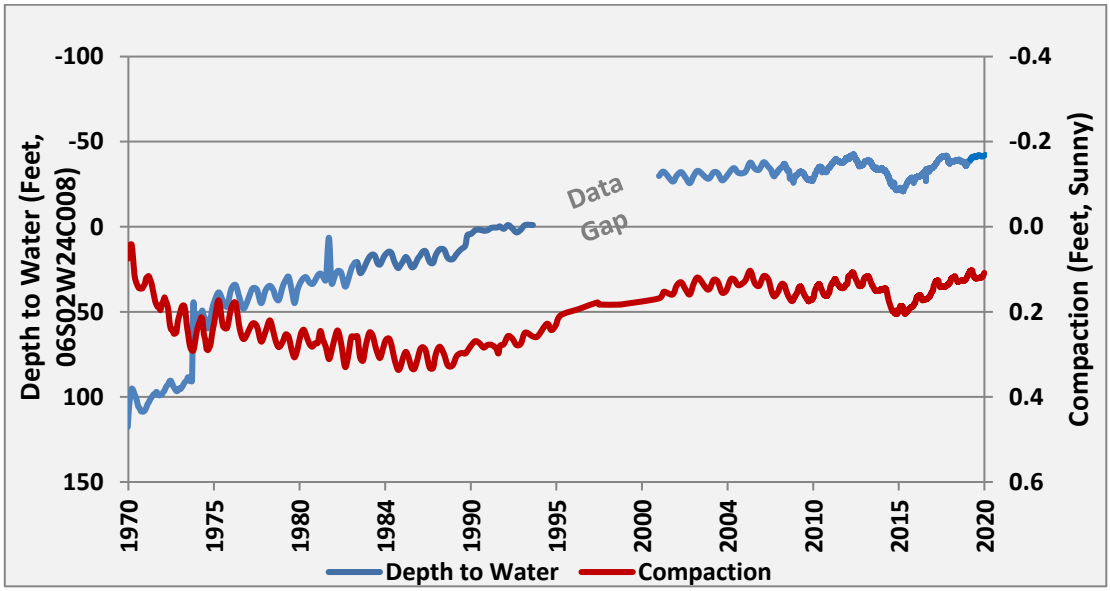
Figure 3. Cumulative compaction at extensometers.

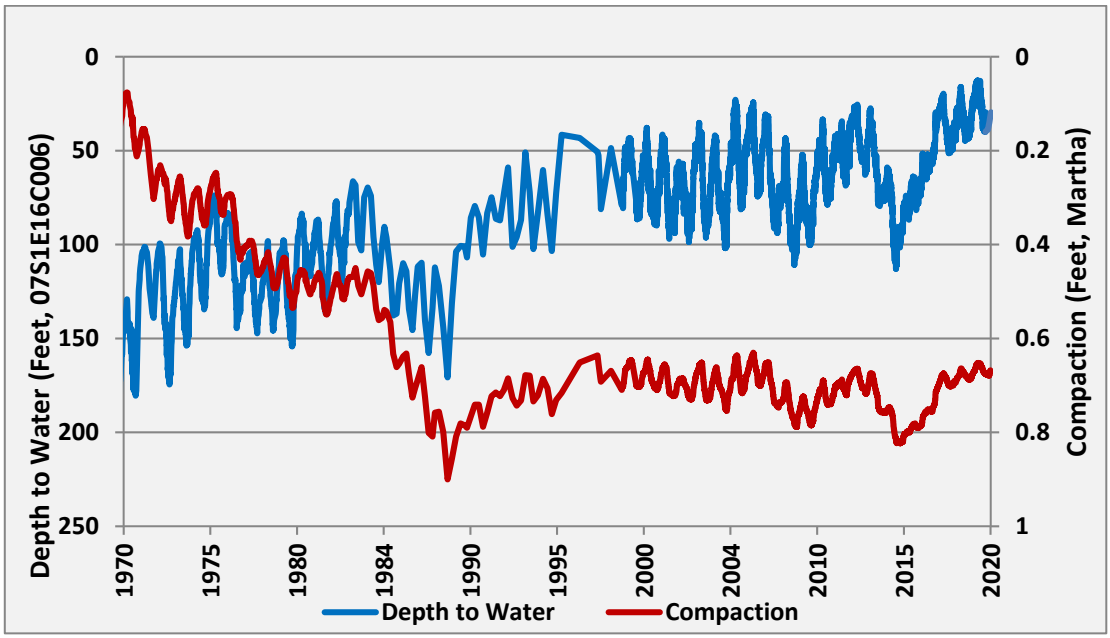




Permanent (inelastic) subsidence was essentially halted in the early 1970s. Figure 4 presents the cumulative aquifer compaction/expansion and DTW from 1970 to 2019 for the Sunny and Martha extensometers, respectively. There are some differences in compaction/expansion and DTW at the two sites during this period: (1) the aquifer compaction since 1970 has been recovered about 83% at Sunny site and only 28% recovered at Martha by the end of 2019; (2) the groundwater elevation at Sunny has been above the land surface (negative DTW) since 1993, while the groundwater elevation at Martha has consistently been below the land surface (positive DTW); and (3) the seasonal water elevation change at Sunny is relatively small when compared to that at Martha. Those differences indicate that the pumping activity and scale at Sunny site is less than that at Martha site. Less pumping and the presence of artesian pressure helped the recovery of compacted aquifer at Sunny site, while continued pumping activity and relatively lower water level resulted in less recovery of compacted aquifer at Martha site from 1970 to 2019.

Figure 4. Measured depth to water and cumulative compaction at extensometers.





Current conditions: Measured extensometer data is used to evaluate current land subsidence conditions. Table 1 shows measured annual subsidence from 2009 to 2019 and the calculated 11-year average at Sunny and Martha. The 11-year average of annual subsidence rate is -0.006 feet/year, with the negative value of extensometer data indicating aquifer expansion (or uplift). This value meets the Valley Water tolerable subsidence rate goal of not exceeding 0.01 feet/year. Comparing to the value reported in the 2018 Subsidence Data Analysis Technical Memorandum, the 11-year average value changed from -0.004 feet/year in 2018 to -0.006 feet/year in 2019, net average uplift of 0.002 feet/year.

Table 1. Measured annual land subsidence at the Sunnyvale (Sunny) and San Jose (Martha) extensometers from 2009 to 2019

Year	Sunny (feet/year)	Martha (feet/year)	Average at Two Sites (feet/year)
2009	0.008	-0.020	-0.006
2010	-0.025	-0.024	-0.025
2011	-0.009	-0.032	-0.021
2012	-0.014	0.013	-0.001
2013	0.026	0.064	0.045
2014	0.049	0.053	0.051
2015	-0.022	-0.021	-0.022
2016	-0.025	-0.087	-0.056
2017	-0.018	-0.007	-0.013
2018	-0.013	-0.020	-0.017
2019	-0.009	-0.005	-0.007
Average from 2009 – 2019	-0.004	-0.008	**-0.006**

Notes: negative values indicate expansion, or uplift in Table 1.

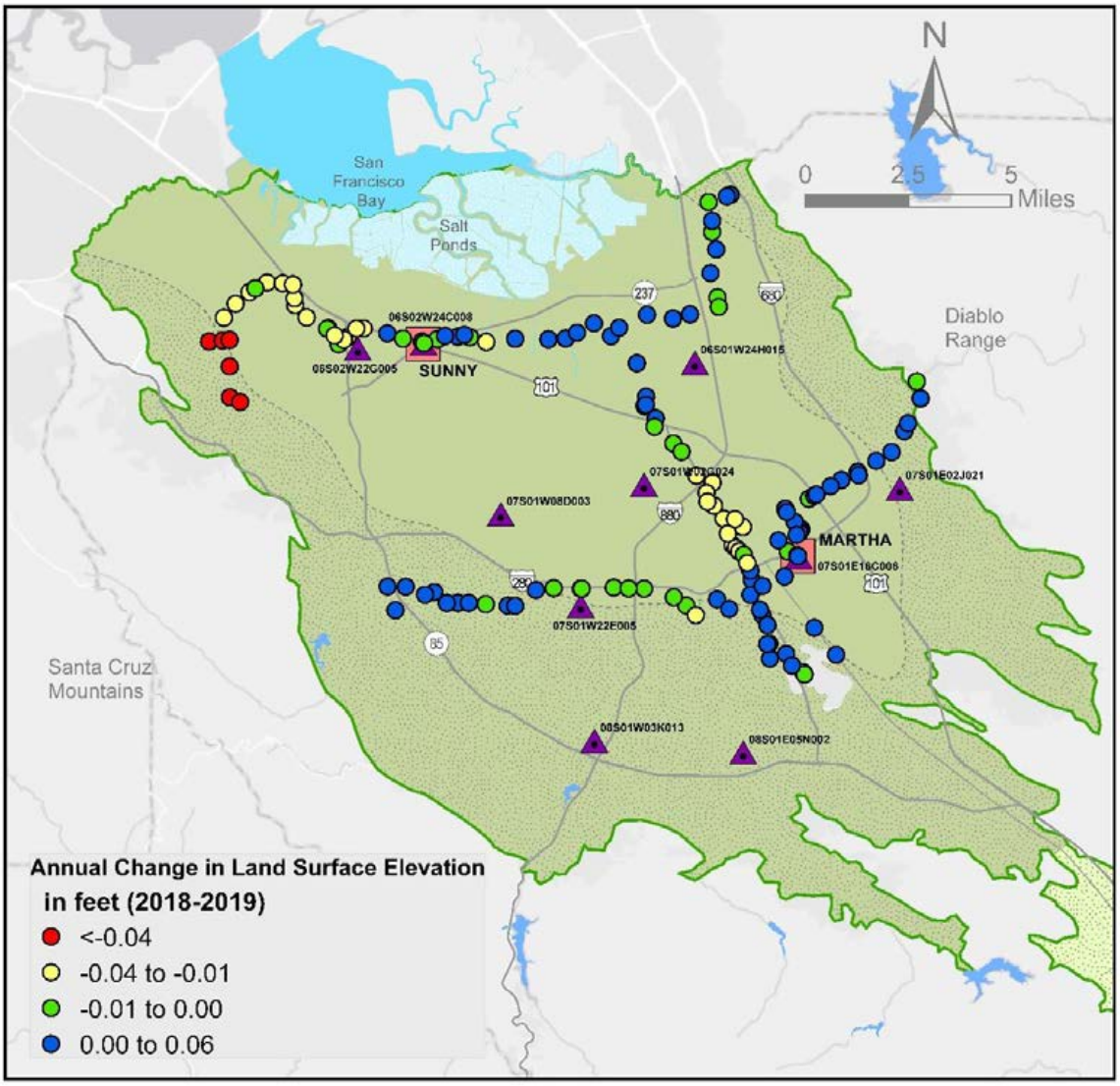
Benchmark survey data analysis

The benchmark survey data along the Los Altos, Alum Rock, and Guadalupe CVLCs are used to study spatial land subsidence conditions and annual changes throughout the Santa Clara Plain. The benchmark survey is conducted in the fall of each year. Figure 1 shows benchmark locations along the three CVLCs surveyed in 2019. Related analysis is summarized below.

Change in land surface elevation from 2018 to 2019: As discussed above, 2019 groundwater elevations remained relatively high throughout the Santa Clara Plain. Figure 5 shows the annual change in land surface elevation from 2018 to 2019 at benchmarks along the Los Altos, Alum Rock, and Guadalupe circuits. For benchmark survey data, a positive value indicates an increase in land surface elevation (uplift) and a negative value indicates a decrease in land surface elevation (subsidence); this is the opposite of the extensometer data.

The 2019 survey data showed a trend of positive land surface elevation changes (uplift) from 2018 at the majority of benchmarks (Figure 5). However, some relatively minor compaction was observed along the western portion of Los Altos circuit, central portion of the Guadalupe circuit, and western portion of the Alum Rock circuit (Figure 5).

Figure 5. Land surface elevation change at benchmarks between 2018 and 2019.



Notes: positive values indicate land surface uplift and negative values indicate land surface subsidence in Figure 5.

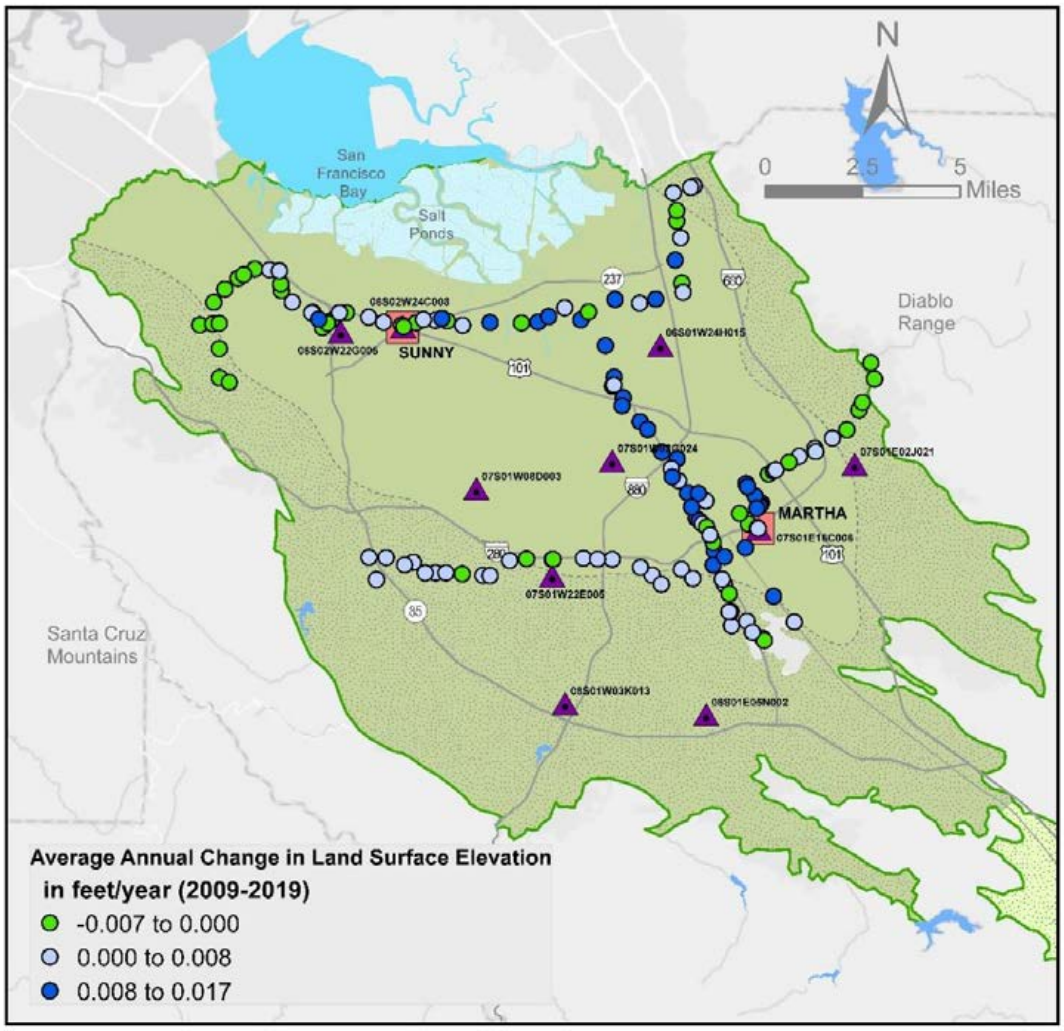
Table 2 summarizes the average and range of annual change of land surface elevation from 2018 to 2019. The average annual change of land surface elevation along each of the three survey circuits in 2019 is close to zero. The risk of land subsidence of 2019 was low.

Table 2. Fall 2019 change in land surface elevation for benchmark circuits compared to Fall 2018.

Survey Circuit	Average Change (feet)	Range (feet)	Number of Benchmarks
Los Altos	-0.01	-0.08 to 0.02	39
Alum Rock	0.02	-0.02 to 0.06	49
Guadalupe	0.00	-0.04 to 0.02	50

Long-term change in land surface elevation: The average annual change of land surface elevation over the last 11 years from 2009 to 2019 at individual benchmarks is presented in Figure 6. Although land surface elevations at some benchmarks increased or decreased at higher values in some years, the average annual change at most benchmarks was within the range of -0.01 to 0.01 feet/year, which is less than the Valley Water's tolerable rate of 0.01 feet/year subsidence.

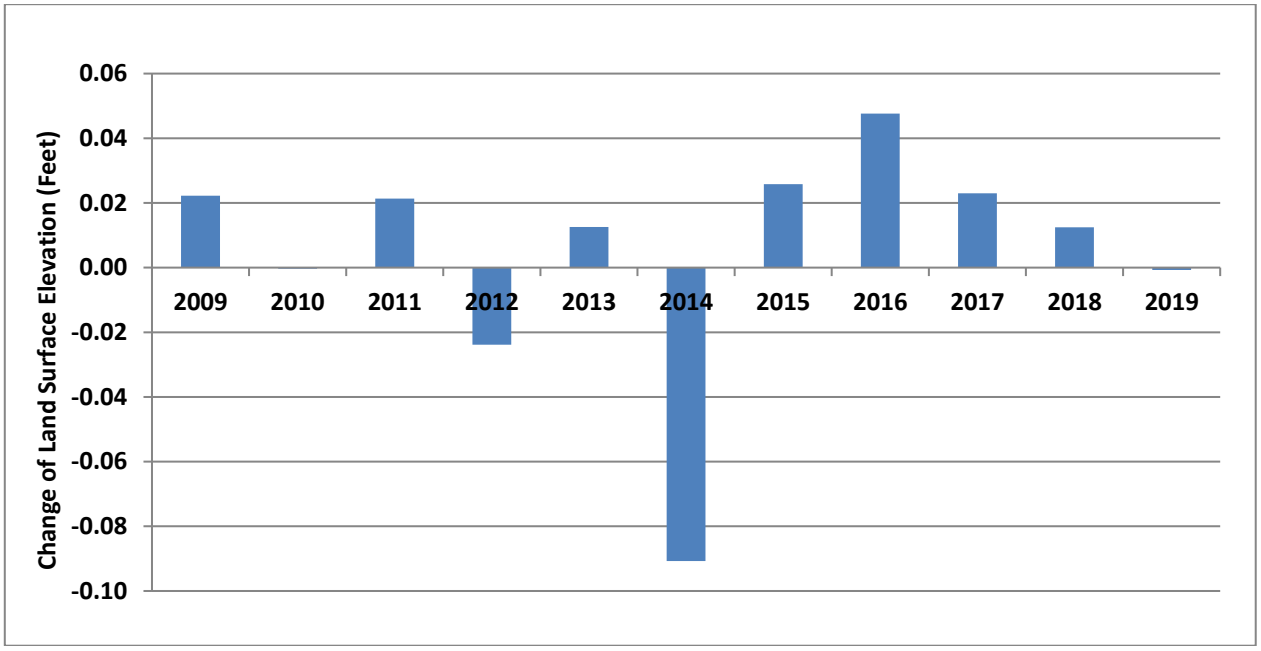
Figure 6. Average annual change of land surface elevation at benchmarks between 2009 and 2019.



Notes: positive values indicate land surface uplift and negative values indicate land surface subsidence in Figure 6.

Figure 7 shows the average annual change in land surface elevation at all benchmarks over the last 11 years from 2009 to 2019. During this 11-year period, there were seven years with positive values (uplift) and four years with negative values (subsidence). The highest annual subsidence was in 2014 and highest annual uplift was in 2016. The average annual ground surface elevation change over the last eleven years is 0.00 feet, indicating no net change.

Figure 7. Average annual change of land surface elevation of all benchmarks from 2009 to 2019.



In summary, the benchmark survey data show a slight land surface uplift along the three CVLCs corresponding with relatively high and stable groundwater elevations in 2019. The risk of land subsidence in 2019 was low, and about same as 2018. The average annual change of land surface elevation in the last 11 years at all benchmarks is 0.00 feet, which corroborates closely to the extensometer data.

Discussion

As shown in Figure 1, the current land subsidence monitoring network consists of two extensometers, 138 benchmarks along three CVLCs, and ten subsidence groundwater monitoring wells, covering most of the Santa Clara Plain. The extensometers monitor subsidence conditions at two sites with high-quality subsidence and water elevation data. The annual survey provides data representing the subsidence condition at benchmarks along three CVLCs. The monitoring of water elevations at subsidence index wells does not provide data to quantify the subsidence condition directly, but the monitoring is straightforward and related data can be used as an indicator for subsidence condition. Since the index wells are located throughout the Santa Clara Plain, the monitoring data reflects regional conditions.

The current Valley Water practice of evaluating the land subsidence condition in the Santa Clara Plain is to calculate the average over an 11-year period using subsidence data collected at two extensometers (Sunny and Martha) and compare it with the established, tolerable rate of land subsidence. The

tolerable subsidence rate of 0.01 feet/year is based on the arithmetic average of historic subsidence and rebound measured in the Sunny and Martha extensometers for the 11-year period from 1980 to 1990 (GEOSCIENCE, 1991). Re-evaluation of the tolerable subsidence rate may be warranted to ensure the rate remains aligned with local groundwater management goals.

The subsidence thresholds established at ten index wells are used as the minimum water elevations that should be maintained to avoid further permanent land subsidence. Although the thresholds were established more than twenty years ago, they were based on a thorough study of historical data, subsidence modeling, and previous studies. It is recommended to continue to use these thresholds for groundwater operations and early indication of potential concerns. Because these thresholds are based on the 0.01 feet/year tolerable subsidence rate, they should be re-evaluated if the tolerable subsidence rate changes or if other information indicates a change is warranted.

The annual survey at benchmarks provides direct measurement of land surface changes along three CVLCs in the Santa Clara Plain. Valley Water will consider whether specific criteria should be developed to analyze survey data.

CONCLUSIONS

In summary, the data measured by each component of the subsidence monitoring network shows that:

- There was little change from 2018 to 2019 in the average groundwater elevations at the ten subsidence index wells. In general, 2019 groundwater elevations were close to or at historical high levels throughout the Santa Clara Plain. Groundwater elevations were higher than the subsidence thresholds at all ten index wells in 2019 in the Santa Clara Plain.
- Net aquifer expansion (or uplift) was measured at both extensometer sites in 2019. The average annual subsidence rate over the last 11 years at the Martha and Sunny sites is -0.006 feet/year, which meets Valley Water's tolerable rate of 0.01 feet/year.
- The benchmark survey data showed that the land surface elevation in 2019 was similar to 2018, the average annual change of land surface elevation over last 11 years was 0.00 feet (no net change).

The analysis of the data collected through the Valley Water subsidence monitoring network indicates that the risk of land subsidence in 2019 remains low. Continued monitoring of the subsidence network is recommended to detect early signs of inelastic land subsidence and to support sustainable groundwater supply.

REFERENCES

1. GEOSCIENCE Support Services Incorporated, 1991, Subsidence Threshold in the North County Area of Santa Clara Valley.
2. Santa Clara Valley Water District (SCVWD), 2016, Groundwater Management Plan for the Santa Clara and Llagas Subbasins.
3. Valley Water, 2019, 2018 Subsidence Data Analysis, Technical Memorandum (Memo).

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APPENDIX B

Annual Groundwater Quality Summary Report

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Valley Water

Annual Groundwater Quality Summary

Did you know that groundwater is an essential local water resource, providing about half of the water used in Santa Clara County? The Santa Clara Water District (Valley Water) is committed to ensuring sustainable water supplies now and in the future. Valley Water's 2019 groundwater quality testing indicates generally high groundwater quality. We remain steadfast in our efforts to maintain this level of groundwater quality.

Valley Water works to safeguard groundwater by:

- Replenishing groundwater with local and imported surface water.
- Reducing the demand on groundwater with alternative water sources, water conservation, and water recycling.
- Monitoring groundwater quality and water levels.
- Implementing programs to protect groundwater from contamination.

You can help protect groundwater by:

- Maintaining wells and septic systems and avoiding the use or storage of potential contaminants near wells.
- Conserving water and by raising awareness that activities above ground can affect our largest drinking water reservoir, which is beneath our feet.

Clean Water • Healthy Environment • Flood Protection

What influences groundwater quality?

As water travels over the land and through the ground, it dissolves naturally occurring minerals and may also pick up substances from animal and human activities, such as:

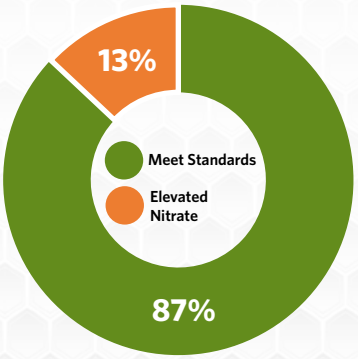
- Inorganic compounds like salts and metals from natural or industrial sources, animal facilities, farming, and mining.
- Organic chemicals from industrial processes, gas stations, dry cleaners, agricultural uses, and septic systems.
- Insecticides, herbicides, and fertilizers from agricultural and residential uses.
- Viruses and bacteria from sewage treatment plants, sewer lines, septic systems, agricultural operations, and wildlife.
- Radioactive elements that are naturally occurring.

Our Guide for the Private Well Owner offers helpful tips!

How do I know if my water is safe?

State and federal drinking water standards identify contaminant levels that relate to health risk. Public water systems must meet these standards, but domestic wells are not regulated. Valley Water tests regional groundwater quality, but every property and well is unique, so we encourage domestic well owners to regularly test their water. The most common contaminant found in Santa Clara County is nitrate.

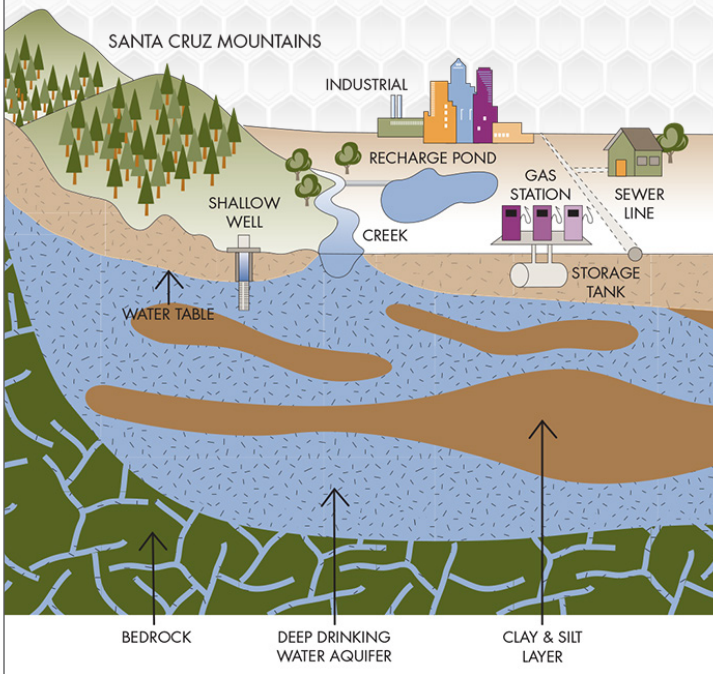
Water Supply Wells Tested Meeting Drinking Water Standards

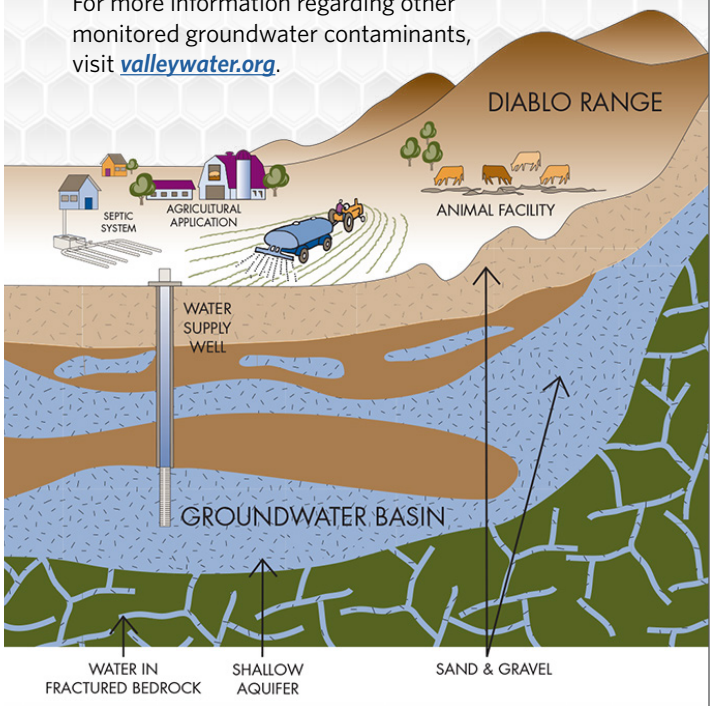


Notes:
1. Graph shows primary drinking water standards.
2. All wells not meeting primary drinking water standards were South County wells with high nitrate (above 10 milligrams per liter).

Nitrate is present above the drinking water standard in many South County domestic wells due to fertilizers, septic systems and livestock waste. Nitrate can interfere with the blood's ability to transport oxygen and is of greatest concern for infants and pregnant women as it can cause serious illness; symptoms include shortness of breath and blueness of the skin.

For more information regarding other monitored groundwater contaminants, visit *valleywater.org*.





	Primary Drinking Water Standards	Units	MCL	Sources	North County Median	North County Range	South County Median	South County Range
Inorganic Contaminants	Aluminum	ppb	1,000	a	16	ND - 200	25	ND - 180
	Arsenic	ppb	10	a,b	ND	ND - 3	ND	ND - 4
	Asbestos	MFL	7	a	--	--	1.0	ND - 1.4
	Barium	ppb	1,000	a	115	ND - 260	79	ND - 190
	Chromium (total)	ppb	50	a,b	2.9	ND - 7.2	1.1	ND - 1.7
	Copper[1]	ppb	1,300	a,c	2	ND - 6.7	1.7	ND - 8.1
	Cyanide	ppb	150	a	ND	ND - 77	ND	ND
	Fluoride (Natural Source)	ppm	2	a	0.12	ND - 0.29	0.13	ND - 0.67
	Lead[1]	ppb	15	a,b,c	ND	ND - 4.6	ND	ND - 1.0
	Nickel	ppb	100	a,b	ND	ND - 1.3[3]	ND	ND - 7.1
	Nitrite (as N)	ppb	1	a,d	ND	ND	ND	ND - 0.5
	Nitrate + Nitrite (as N)	ppm	10	a,d	2.8	0.93 - 5.7	1.2	ND - 4.6
	Nitrate (as N)	ppm	10	a,d	3.1	ND - 8.7	5.8	ND - 42
	Perchlorate	ppb	6	e	ND	ND	ND	ND - 4.8
	Selenium	ppb	50	a	ND	ND - 5.4	ND	ND - 7.0
Radioactive Contaminants	Gross Alpha	pCi/L	15	a	ND	ND - 6.5	1.5	0.72 - 3.3
	Strontium-90	pCi/L	8	a	0.14	0.14	--	--
Volatile Organic Compounds	1,1,1-Trichloroethane (1,1,1-TCA)	ppb	200	b,f	ND	ND - 1.3	ND	ND
	1,1-Dichloroethene (1,1-DCE)	ppb	6	b	ND	ND - 0.78	ND	ND
	Tetrachloroethene (PCE)	ppb	5	b,f	ND	ND	ND	ND - 2.4
	Total Trihalomethanes (THMs)	ppb	80	g	ND	ND - 7.08	--	--
					Present	Absent	Present	Absent
Microbiological Contaminants[2]	E. Coli Bacteria	P/A	--	h	0	12	5	135
	Total Coliform Bacteria	P/A	--	i	4	8	39	101
	Secondary Drinking Water Standards	**Units**	**MCL**	**Sources**	**Median**	**Range**	**Median**	**Range**
	Chloride	ppm	250	a,j	48	31 - 83	50	14 - 155
	Color	Color units	15	a	ND	ND - 7	3	ND - 5
	Iron	ppb	300	a,b	56	ND - 2,100	ND	ND - 2,800
	Manganese	ppb	50	a,b	ND	ND - 84.1	ND	ND - 150
	Odor Threshold	TON	3	a	ND	ND - 4	ND	ND
	pH	pH units	6.5 - 8.5	a,k	7.7	6.5 - 8.7	7.4	6.7 - 8.0
	Specific Conductance	uS/cm	900	a,j	700	139 - 1,100	632	422 - 1,260
	Sulfate	ppm	250	a,b	44	8 - 120	38	ND - 214
	Total Dissolved Solids (TDS)	ppm	500	a	410	272 - 660	396	22 - 1,640
	Turbidity	NTU	5	l	0.21	ND - 3.4	0.24	ND - 2.6
	Zinc	ppb	5,000	a,b	13	ND - 19	7.2	ND - 57

Water Quality Summary

In 2019, Valley Water sampled over 160 domestic wells and evaluated data from over 225 public water supply wells. Nearly all wells tested meet drinking water standards except for nitrate in some South County domestic wells.

This table summarizes results for detected parameters that have a drinking water standard. Not every well was tested for all substances listed. Comprehensive results are reported in the most recent Annual Groundwater Report at *valleywater.org*. Maximum Contaminant Levels (MCLs) apply only to public water systems but are useful guidelines for domestic wells. This regional summary may not reflect the water quality in individual wells since every property and well is unique.

Table Notes

1) Lead and copper do not have MCLs but have "action levels" as shown, and are regulated by the state for public water systems since they can adversely affect public health.

2) Public water systems are required to ensure that fewer than 5% of samples per month have total coliform present and that no samples have e. coli present. Domestic wells are not subject to these standards.

3) One high nickel result (41 ppb) was not confirmed by follow-up testing. The next highest level measured was 1.3 ppb as shown.

Table Terms and Definitions

Maximum Contaminant Level (MCL): the highest level of a contaminant allowable in public water systems. Primary MCLs are health-based regulatory standards. Secondary MCLs are aesthetic standards and relate to the taste, odor, or appearance of drinking water.
Median: the "middle" value of the results, with half of the values above the median and half of the values below the median.
--: indicates there is no related drinking water standard or that the substance was not tested or detected.
MFL: million fibers per liter
ND: not detected (at laboratory reporting limit)
ppm: parts per million (milligrams per liter)
ppb: parts per billion (micrograms per liter)
pCi/L: picoCuries per liter (a measure of radiation)
TON: threshold odor number
pH units: measure of pH
uS/cm: microSiemens per centimeter (a measure of the dissolved inorganic salt content)
NTU: nephelometric turbidity units

Typical Sources for Listed Substances

a: Erosion of natural deposits
b: Discharge of industrial and manufacturing wastes
c: Internal corrosion of household water plumbing systems
d: Agricultural runoff and leaching of fertilizers, septic tanks, and sewage
e: Solid rocket propellant, fireworks, explosives, flares, matches, and other industrial sources
f: Industrial process, dry cleaners, automotive repair shops, leaking underground fuel tanks, and other industrial sources
g: Drinking water chlorination
h: Human and animal fecal wastes
i: Naturally occurring in environment
j: Seawater influence
k: Carbon dioxide emissions; rainfall
l: Soil runoff

You live on a groundwater basin.

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Valley Water Programs for Well Owners

Individual well owners are responsible for making sure their water is safe to drink, but Valley Water offers several programs to help.

Domestic Well Testing
Valley Water offers free water quality testing for eligible Santa Clara County domestic well users. Testing includes common contaminants like nitrate and bacteria.

Nitrate Treatment Rebates
To reduce exposure to elevated nitrate, Valley Water offers rebates of up to $500 to domestic well owners for nitrate treatment systems. Certain restrictions apply.

For more program information, visit ***valleywater.org*** or call the Groundwater Hotline at (408) 630-2300.

Additional Resources

For more information about contaminants and potential health effects, the following resources are available:

- U.S. Environmental Protection Agency's Safe Drinking Water Hotline at (800) 426-4791
- California Division of Drinking Water (*www.waterboards.ca.gov/drinking_water/programs*)
- Your healthcare provider

Contact Us information

For more information, contact **Victoria Garcia** at **(408) 630-3136** or by e-mail at ***VGarcia@valleywater.org***. To find out the latest information on Valley Water projects or to submit questions or comments, use our **Access Valley Water** customer request system at ***https://delivr.com/2yukx***.

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APPENDIX C
2019 Groundwater Quality Results

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Table C-1 Summary of 2019 Water Quality Indicator Data

Parameter	Units[1]	Santa Clara Subbasin, Santa Clara Plain								Santa Clara Subbasin, Coyote Valley				Maximum Contaminant Level	
		Shallow Zone[2]				Principal Zone[3]									
		n[4]	Min[5]	Median[6]	Max	n	Min	Median	Max	n	Min	Median	Max	MCL[7]	SMCL[8]
Aggressive Index (Corrosivity)	Index	1	13	13	13	52	11	12	13	4	12	12	12	--	--
Total Alkalinity (as CaCO3)	mg/L	20	179	265	592	75	135	240	360	9	160	197	287	--	--
Carbonate Alkalinity (as CaCO3)	mg/L	1	<2	<2	<2	27	<2	<2	2.2	1	<2	<2	<2	--	--
Hydroxide Alkalinity (as CaCO3)	mg/L	1	<2	<2	<2	27	<2	<2	<10	1	<2	<2	<2	--	--
Caffeine	ug/L	2	<0.05	<0.05	<0.05	38	<0.05	<0.05	<0.05	2	<0.05	<0.05	<0.05	--	--
Color	Color Units	1	<3	<3	<3	27	<3	<3	7	1	<3	<3	<3	--	15
Dissolved Oxygen	mg/L	18	1.3	2.9	9.2	19	1.3	2.8	9.2	5	1.5	4.4	6.4	--	--
E. Coli (P/A)	P/A	1	0	1		2	0	2		15	0	15		--	--
Foaming Agents (MBAS)	ug/L	1	<0.1	<0.1	<0.1	27	<0.05	<0.1	<0.1	1	<0.10	<0.10	<0.10	--	500
Hardness (Total, as CaCO3)	mg/L	20	176	335	681	77	78	300	450	24	152	265	544	--	--
Langelier Index @ 60 C	Index	1	1.1	1.1	1.1	29	0.32	1.1	1.4	2	0.42	0.61	0.8	--	--
Odor Threshold @ 60 C	TON	--	--	--	--	54	<1	<1	4	4	<1	<1	<1	--	3
Oxidation Reduction Potential (ORP)	mV	19	-74	60	197	19	-130	77	186	5	-27	114	217	--	--
pH	pH Units	20	6.4	7.2	7.8	87	6.5	7.6	8.7	9	6.5	7.4	7.9	--	6.5 - 8.5
Source Temperature	C	19	14	20	26	31	18	20	28	5	18	19	27	--	--
Specific Conductance	uS/CM	38	497	805	1,510	96	139	670	1,100	14	526	580	883	--	900
Total Organic Carbon (TOC)	mg/L	--	--	--	--	3	<0.3	<0.3	<0.3	--	--	--	--	--	--
Turbidity	NTU	37	<0.01	0.25	7.8	94	<0.1	0.25	22	14	<0.10	0.20	2.6	--	5
Total Coliform (P/A) [9]	P/A	1	1 Present	0 Absent		2	1 Present	1 Absent		15	2 Present	13 Absent		--	--

Table C-1 Summary of 2019 Water Quality Indicator Data

Parameter	Units[1]	Llagas Subbasin								Maximum Contaminant Level	
		Shallow Zone[2]				Principal Zone[3]					
		n[4]	Min[5]	Median[6]	Max	n	Min	Median	Max	MCL[7]	SMCL[8]
Aggressive Index (Corrosivity)	Index	--	--	--	--	6	12	12	13	--	--
Total Alkalinity (as CaCO3)	mg/L	18	105	205	346	27	98	201	352	--	--
Bicarbonate Alkalinity (as CaCO3)	mg/L	1	214	214	214	1	322	322	322	--	--
Color	Color Units	--	--	--	--	1	5	5	5	--	15
Dissolved Oxygen	mg/L	18	1.7	5.2	9.5	19	1.9	5.6	8.6	--	--
E. Coli (MPN)	MPN/100mL	2	<1	<1	<1	2	<1.0	<1.0	<1.0	--	--
E. Coli (P/A)	P/A	15	1	14		37	0	37		--	--
Foaming Agents (MBAS)	ug/L	2	<0.10	<0.10	<0.10	2	<0.03	<0.10	<0.10	--	500
Hardness (Total, as CaCO3)	mg/L	29	91	306	571	49	29	256	510	--	--
Heterotrophic Plate Count	CFU/ml	2	480	490	500	2	320	330	340	--	--
Langelier Index @ 60 C	Index	--	--	--	--	1	0.6	0.6	0.6	--	--
Odor Threshold @ 60 C	Index	--	--	--	--	6	<1.0	<1.0	<1.0	--	3
Oxidation Reduction Potential (ORP)	mV	18	11	145	240	19	-56	123	239	--	--
pH	pH Units	18	6.6	6.9	7.5	27	6.7	7.4	8.9	--	6.5 - 8.5
Source Temperature	C	18	18	20	24	19	18	21	30	--	--
Specific Conductance	uS/CM	35	337	684	1,160	66	460	626	1,260	--	900
Total Coliform (MPN)	MPN/100mL	2	<1	<1	<1	2	<1.0	<1.0	<1.0	--	--
Total Organic Carbon (TOC)	mg/L	--	--	--	--	1	<0.30	<0.30	<0.30	--	--
Turbidity	NTU	31	<0.10	0.5	5.8	42	<0.10	0.3	5.0	--	5
Total Coliform (P/A)[9]	P/A	15	7 Present	8 Absent		37	8 Present	29 Absent		--	--

Table C-1 Summary of 2019 Water Quality Indicator Data (Notes)

Table includes data for wells monitored by Valley Water (annual monitoring network wells and water supply wells) and public water system data reported to the CA Division of Drinking Water (DDW).

Only wells with known construction information are presented in this table. DDW wells are assumed to represent the principal zone if no construction information is available, as these are typically deep wells.

1. ug/L = micrograms per liter; mg/L = milligrams per liter; P/A = present/absent per 100 ml; uS/cm = microSiemens per centimeter; NTU = Nephelometric Turbidity Units; TON = Threshold Odor Number
2. The shallow aquifer zone is represented by wells primarily drawing water from depths less than 150 feet.
3. The principal aquifer zone is represented by wells primarily drawing water from depths greater than 150 feet.
4. n = number of results for each parameter. Some parameters may have been analyzed more than once at a particular well.
5. The minimum shown is the lowest detected value. The lowest reporting limit (e.g., <5) is shown when there are no quantified values at the lowest reporting limit.
6. For parameters with results reported at multiple reporting limits, the median was computed using the Maximum Likelihood Estimate (MLE) method.
7. MCL = Maximum Contaminant Level specified in Title 22 of the California Code of Regulations. The MCL is a health-based drinking water standard.
8. SMCL = Secondary Maximum Contaminant Level, or aesthetic-based standard, per DDW or US EPA. For SMCLs having a range, the lower, recommended threshold is listed first with the upper threshold in parentheses.
9. Total coliform and e. coli bacteria are regulated under the US EPA Total Coliform Rule, which identifies sampling requirements and compliance criteria based on the type of public water system. All wells with data in bacteria results in this table are private, domestic wells that are not subject to federal or state drinking water requirements.

Table C-2 Summary of 2019 Inorganic Data

Parameter	Units[1]	Santa Clara Subbasin, Santa Clara Plain								Santa Clara Subbasin, Coyote Valley				Maximum Contaminant Level	
		Shallow Zone[2]				Principal Zone[3]									
		n[4]	Min[5]	Median[6]	Max	n	Min	Median	Max	n	Min	Median	Max	MCL[7]	SMCL[8]
Major and Minor Ions															
Bicarbonate (as HCO3)	mg/L	20	218	336	722	75	165	290	450	9	195	241	350	--	--
Bromide	mg/L	19	<0.1	0.2	0.4	25	<0.1	0.16	0.24	19	<0.1	0.16	1.8	--	--
Calcium	mg/L	20	37	74	156	75	16	66	131	10	7.5	48	81	--	--
Calcium (as CaCO3)	mg/L	19	91	190	390	19	40	139	328	5	19	124	155	--	--
Carbon Dioxide	ug/L	1	8,300	8,300	8,300	45	4.2	1,793	11,000	1	4,500	4,500	4,500	--	--
Chloride	mg/L	20	23	55	86	75	10	46	83	9	14	43	85	--	250
Cyanide	ug/L	1	<100	<100	<100	39	<2	<5	77	3	<100	<100	<100	150	
Fluoride (natural source)	mg/L	20	<0.1	0.1	0.6	86	<0.05	0.12	0.3	22	<0.1	0.14	0.26	2	--
Magnesium	mg/L	20	11	38	71	75	7.2	28	65	10	28	34	61	--	--
Perchlorate	ug/L	20	<4	<4	<4	55	<2	<4	<4	9	<4	<4	<4	6	--
Potassium	mg/L	20	0.6	1.3	2.3	70	<1	1.3	4.1	8	<1	1.2	1.9	--	--
Sodium	mg/L	20	22	40	163	75	15	31	106	10	17	28	104	--	--
Sodium Adsorption Ratio	ratio	20	0.64	1.1	4.4	74	0.53	0.9	5.9	9	0.52	0.9	3.3	--	--
Sulfate	mg/L	20	25	59	359	77	6.4	44	120	23	<0.5	42	104	--	250
Total Dissolved Solids (TDS)	mg/L	20	304	451	1,020	77	238	410	660	29	256	384	1,640	--	500
Nutrients															
Ammonia (NH3-N)	mg/L	--	--	--	--	3	<0.05	<0.05	<0.05	--	--	--	--	--	--
Nitrate (as N)	mg/L	20	<0.1	0.8	5.3	272	<0.1	3.1	9.1	40	<0.1	4.2	18	10	--
Nitrate + Nitrite (as N)	mg/L	1	3.7	3.7	3.7	55	0.93	2.8	5.7	6	0.5	0.73	1.6	10	--
Nitrite (as N)	mg/L	1	<0.4	<0.4	<0.4	65	<0.05	<0.4	<0.4	7	<0.4	<0.4	<0.4	1	--
Orthophosphate (as PO4)	mg/L	19	<0.1	0.2	1.3	24	<0.1	0.1	1.6	19	<0.1	<0.1	0.5	--	--
Trace Elements															
Aluminum	ug/L	20	<20	25	39	87	<20	25	200	8	<20	20.5	180	1,000	200
Antimony	ug/L	20	<1	<1	<6	81	<0.5	<6	<6	8	<1	<1	<6	6	--
Arsenic	ug/L	20	<2	<2	10	82	<2	<2	5	8	<2	<2	2	10	--
Asbestos	MFL	--	--	--	--	1	<0.2	<0.2	<0.2	--	--	--	--	7	--
Barium	ug/L	20	35	120	320	81	<100	110	270	8	<100	93	260	1,000	--
Beryllium	ug/L	20	<1	<1	<1	81	<0.5	<1	<1	8	<1	<1	<1	4	--
Boron	ug/L	19	88	170	702	22	<100	128	282	5	<50	112	150	--	--
Cadmium	ug/L	20	<1	<1	<1	82	<0.2	<1	<1	8	<1	<1	<1	5	--
Chromium	ug/L	20	<1	<1	3	84	<1	1.6	9	8	<1	1.6	4	50	--
Chromium 6 (Hexavalent)	ug/L	19	<1	<1	3.1	34	<1	1.2	10	7	<1	1.8	5.3	--	--
Cobalt	ug/L	19	<1	<1	<1	24	<1	<1	0	5	<1	<1	<1	--	--
Copper[9]	ug/L	20	<1	<1	2	84	<1	<1	6.7	9	<1	<1	<50	1,300	1,000
Iron	ug/L	20	<20	<20	150	132	<20	22	2,100	13	<20	<20	360	--	300
Lead[9]	ug/L	20	<1	<1	<5	84	<1	<1	5	8	<1	<1	<5	15	--
Lithium	ug/L	19	<5	7.2	21	22	<5	6.8	29	5	9.4	11	25	--	--
Manganese	ug/L	20	<1	19	988	94	<1	13	143	9	<1	1.4	107	--	50
Mercury	ug/L	20	<1	<1	<1	80	<0.2	<1	<1	8	<1	<1	<1	2	--
Molybdenum	ug/L	19	<1	2.1	27	24	<1	0.82	13	5	<1	<1	12	--	--
Nickel	ug/L	20	<1	<1	2	83	<1	<10	41	8	<1	<1	<10	100	--
Selenium	ug/L	20	<5	<5	<5	81	<2	1.6	6	8	<5	<5	<5	50	--
Silica	mg/L	19	20	24	35	22	19	28	41	5	22	23	40	--	--
Silver	ug/L	20	<1	<1	<10	75	<1	<10	<10	9	<1	<1	<10	--	100
Thallium	ug/L	20	<1	<1	<1	82	<0.5	<1	<1	8	<1	<1	<1	2	--
Vanadium	ug/L	19	<1	1.8	3.9	25	<1	1.8	8.9	5	<1	1.4	9.2	--	--
Zinc	ug/L	20	<10	<10	28	78	<10	<10	24	9	<10	<10	12	--	5,000

Table C-2 Summary of 2019 Inorganic Data

Parameter	Units[1]	Llagas Subbasin								Maximum Contaminant Level	
		Shallow Zone				Principal Zone					
		n	Min	Median	Max	n	Min	Median	Max	MCL[7]	SMCL[8]
Major and Minor Ions											
Bicarbonate (as HCO3)	mg/L	17	128	250	422	24	120	245	430	--	--
Bromide	mg/L	29	<0.1	0	0.38	43	<0.1	0	0.7	--	--
Calcium	mg/L	18	38	61	102	27	3	53	100	--	--
Calcium (as CaCO3)	mg/L	18	95	152	256	19	87	138	250	--	--
Chloride	mg/L	18	9	46	79	26	17	48	155	--	250
Cyanide	ug/L	2				11		<100	<100	150	
Fluoride (natural source)	mg/L	29	<0.1	0.1	0.61	51	<0.1	0.1	0.47	2	--
Magnesium	mg/L	18	21	38	77	25	20	31	56	--	--
Perchlorate	ug/L	18	<4	<4	<4	52	<2	<2	4.8	6	--
Potassium	mg/L	18	<0.5	1	2.1	23	<0.5	1	1.9	--	--
Sodium	mg/L	18	12	27	78	26	14	31	110	--	--
Sodium Adsorption Ratio	ratio	17	0.40	1	2.0	24	0.35	1	4.0	--	--
Sulfate	mg/L	29	8.7	37	214	50	3.9	42	96	--	250
Total Dissolved Solids (TDS)	mg/L	29	214	384	834	51	254	404	760	--	500
Nutrients											
Nitrate (as N)	mg/L	29	<0.1	6	52	170	<0.4	5	42	10	--
Nitrate + Nitrite (as N)	mg/L	--	--	--	--	10	<0.4	4	4.6	10	--
Nitrite (as N)	mg/L	--	--	--	--	20	<0.4	<0.4	0.5	1	--
Orthophosphate (as PO4)	mg/L	28	<0.1	<0.1	1.1	42	<0.1	<0.1	1	--	--
Trace Elements											
Aluminum	ug/L	18	<20	23	37	27	<20	24	44	1,000	200
Antimony	ug/L	18	<1	<1	<1	27	<1	<1	<6	6	--
Arsenic	ug/L	18	<2	<2	<2	27	<2	<2	4	10	--
Asbestos	MFL	--	--	--	--	3	<0.2	1	1.4	7	--
Barium	ug/L	18	11	120	380	27	<100	95	490	1,000	--
Beryllium	ug/L	18	<1	<1	<1	27	<1	<1	<1	4	--
Boron	ug/L	18	<50	110	180	23	<50	95	262	--	--
Cadmium	ug/L	18	<1	<1	<1	27	<1	<1	<1	5	--
Chromium	ug/L	18	<1	1	4.4	27	<1	1	2.5	50	--
Chromium 6 (Hexavalent)	ug/L	16	<1	<1	4.3	17	<1	1	1.9	--	--
Cobalt	ug/L	18	<1	<1	<1	19	<1	<1	<1	--	--
Copper[9]	ug/L	18	<1	<1	8.1	27	<1	2	7.3	1,300	1,000
Iron	ug/L	18	<20	<20	350	30	<20	9	2,800	--	300
Lead[9]	ug/L	18	<1	<1	1.1	29	<1	<1	<5	15	--
Lithium	ug/L	18	<5	8	32	19	<5	10	26	--	--
Manganese	ug/L	18	<1	<1	37	26	<1	1	150	--	50
Mercury	ug/L	18	<1	<1	<1	27	<1	<1	<1	2	--
Molybdenum	ug/L	18	<1	<1	1.1	19	<1	<1	4.5	--	--
Nickel	ug/L	18	<1	1	2.3	27	<1	<1	7	100	--
Selenium	ug/L	18	<5	<5	6	27	<5	<5	7	50	--
Silica	mg/L	18	21.4	29	43	21	22	28	51	--	--
Silver	ug/L	18	<1	<1	<1	25	<1	<1	<10	--	100
Thallium	ug/L	18	<1	<1	<1	27	<1	<1	<1	2	--
Vanadium	ug/L	18	<1	2	14	19	<1	2	12	--	--
Zinc	ug/L	18	<10	<10	120	25	<10	6	95	--	5,000

Table C-2 Summary of 2019 Inorganic Data (Notes)

Table includes data for wells monitored by the Valley Water (annual monitoring network wells and water supply wells) and public water system data reported to the CA Division of Drinking Water (DDW).

Only wells with known construction information are presented in this table. DDW wells are assumed to represent the principal zone if no construction information is available, as these are typically deep wells.

1. mg/L = milligrams per liter; ug/L = micrograms per liter; MFL = million fibers per liter.
2. The shallow aquifer zone is represented by wells primarily drawing water from depths less than 150 feet.
3. The principal aquifer zone is represented by wells primarily drawing water from depths greater than 150 feet.
4. n = number of results for each parameter. Some parameters may have been analyzed more than once at a particular well.
5. The minimum shown is the lowest detected value. The lowest reporting limit (e.g., <5) is shown when there are no quantified values at the lowest reporting limit.
6. For parameters with results with multiple reporting limits, the median was computed using the Maximum Likelihood Estimate (MLE) method.
7. MCL = Maximum Contaminant Level specified in Title 22 of the California Code of Regulations. The MCL is a health-based drinking water standard.
8. SMCL = Secondary Maximum Contaminant Level, or aesthetic-based standard, per DDW or US EPA. For SMCLs having a range, the lower, recommended threshold is listed first with the upper threshold in parentheses.
9. Lead and copper do not have primary MCLs but have "action levels" of 15 and 1,300 ppb, respectively. These substances are regulated by the state for public water systems since they can adversely affect public health.

Table C-3 Summary of 2019 Volatile Organic Compound (VOC) Data (Detect/Non-Detect)

Parameter	Units[1]	Santa Clara Subbasin, Santa Clara Plain						Santa Clara Subbasin, Coyote Valley			Llagas Subbasin						Maximum Contaminant Level	
		Shallow Zone[2]			Principal Zone[3]						Shallow Zone			Principal Zone				
		n[4]	Result[5]	RL[6]	n	Result	RL	n	Result	RL	n	Result	RL	n	Result	RL	MCL[7]	SMCL[8]
1,1,1,2-Tetrachlorethane	ug/L	13	ND	0.5	63	ND	0.5	7	ND	0.5	18	ND	0.5	20	ND	0.5	--	--
1,1,1-Trichloroethane	ug/L	13	**D**	0.5	115	ND	0.5	8	ND	0.5	18	ND	0.5	57	ND	0.5	200	--
1,1,2,2-Tetrachloroethane	ug/L	13	ND	0.5	114	ND	0.5	8	ND	0.5	18	ND	0.5	57	ND	0.5	1	--
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	ug/L	13	**D**	2	114	**D**	2	8	ND	10	18	ND	2	57	ND	10	1,200	--
1,1,2-Trichloroethane	ug/L	13	ND	0.5	114	ND	0.5	8	ND	0.5	18	ND	0.5	57	ND	0.5	5	--
1,1-Dichloroethane	ug/L	13	ND	0.5	114	ND	0.5	8	ND	0.5	18	ND	0.5	57	ND	0.5	5	--
1,1-Dichloroethene	ug/L	13	ND	0.5	114	ND	0.5	8	ND	0.5	18	ND	0.5	57	ND	0.5	6	--
1,1-Dichloropropene	ug/L	13	ND	0.5	51	ND	0.5	7	ND	0.5	18	ND	0.5	20	ND	0.5	--	--
1,2,3-Trichlorobenzene	ug/L	13	ND	0.5	63	ND	0.5	7	ND	0.5	18	ND	0.5	20	ND	0.5	--	--
1,2,3-Trichloropropane	ug/L	12	ND	0.5	179	ND	0.5	19	ND	0.5	18	ND	0.5	54	ND	0.5	0.005	--
1,2,4-Trichlorobenzene	ug/L	13	ND	0.5	114	ND	0.5	8	ND	0.5	18	ND	0.5	57	ND	0.5	--	--
1,2,4-Trimethylbenzene	ug/L	13	ND	0.5	63	ND	0.5	7	ND	0.5	18	ND	0.5	20	ND	0.5	5	--
1,2-Dichlorobenzene	ug/L	13	ND	0.5	114	ND	0.5	8	ND	0.5	18	ND	0.5	57	ND	0.5	600	--
1,2-Dichloroethane	ug/L	13	ND	0.5	114	ND	0.5	8	ND	0.5	18	ND	0.5	57	ND	0.5	0.5	--
1,2-Dichloropropane	ug/L	13	ND	0.5	114	ND	0.5	8	ND	0.5	18	ND	0.5	57	ND	0.5	5	--
1,3,5-Trimethylbenzene	ug/L	13	ND	0.5	63	ND	0.5	7	ND	0.5	18	ND	0.5	20	ND	0.5	--	--
1,3-Dichlorobenzene	ug/L	13	ND	0.5	63	ND	0.5	7	ND	0.5	18	ND	0.5	20	ND	0.5	--	--
1,3-Dichloropropane	ug/L	13	ND	0.5	51	ND	0.5	7	ND	0.5	18	ND	0.5	20	ND	0.5	--	--
1,3-Dichloropropene (Total)	ug/L	13	ND	0.5	114	ND	0.5	8	ND	0.5	18	ND	0.5	57	ND	0.5	0.5	--
cis-1,3-Dichloropropene	ug/L	13	ND	0.5	49	ND	0.5	6	ND	0.5	18	ND	0.5	19	ND	0.5	--	--
trans-1,3,Dichloropropene	ug/L	13	ND	0.5	49	ND	0.5	6	ND	0.5	18	ND	0.5	19	ND	0.5	--	--
1,4-Dichlorobenzene	ug/L	13	ND	0.5	114	ND	0.5	8	ND	0.5	18	ND	0.5	57	ND	0.5	5	--
1-Phenylpropane (n-Propylbenzene)	ug/L	13	ND	0.5	63	ND	0.5	7	ND	0.5	18	ND	0.5	20	ND	0.5	--	--
2,2-Dichloropropane	ug/L	13	ND	0.5	50	ND	0.5	7	ND	0.5	18	ND	0.5	20	ND	0.5	--	--
2,4-Dinitrotoluene	ug/L	2	ND	5	35	ND	5	2	ND	5	--	--	--	--	--	--	--	--
2-Chlorotoluene	ug/L	13	ND	0.5	63	ND	0.5	7	ND	0.5	18	ND	0.5	20	ND	0.5	--	--
4-Chlorotoluene	ug/L	13	ND	0.5	63	ND	0.5	7	ND	0.5	18	ND	0.5	20	ND	0.5	--	--
Benzene	ug/L	13	ND	0.5	114	ND	0.5	8	ND	0.5	18	ND	0.5	57	ND	0.5	1	--
Benzo (a) Pyrene	ug/L	2	ND	0.1	45	ND	0.1	4	ND	0.1	--	--	--	8	ND	0.1	0.2	--
Bromobenzene	ug/L	13	ND	0.5	51	ND	0.5	7	ND	0.5	18	ND	0.5	20	ND	0.5	--	--
Bromochloroacetic Acid (BCAA)	ug/L	--	--	--	--	--	--	--	--	--	2	ND	1	2	ND	1	--	--

Table C-3 Summary of 2019 Volatile Organic Compound (VOC) Data (Detect/Non-Detect)

Parameter	Units[1]	Santa Clara Subbasin, Santa Clara Plain						Santa Clara Subbasin, Coyote Valley			Llagas Subbasin						Maximum Contaminant Level	
		Shallow Zone[2]			Principal Zone[3]						Shallow Zone			Principal Zone				
		n[4]	Result[5]	RL[6]	n	Result	RL	n	Result	RL	n	Result	RL	n	Result	RL	MCL[7]	SMCL[8]
Bromochloromethane	ug/L	13	ND	0.5	51	ND	0.5	7	ND	0.5	18	ND	0.5	20	ND	0.5	--	--
Bromodichloroacetic Acid (BDCAA)	ug/L	--	--	--	--	--	--	--	--	--	2	ND	1	2	ND	1	--	--
Bromodichloromethane (THM)	ug/L	13	ND	1	63	**D**	1	7	ND	1	18	ND	0.5	20	ND	1	--	--
Bromoform (THM)	ug/L	13	ND	1	63	**D**	1	7	ND	1	18	ND	0.5	20	**D**	1	--	
Bromomethane	ug/L	13	ND	0.5	50	ND	0.5	7	ND	0.5	18	ND	0.5	20	ND	0.5	--	--
Carbon Disulfide	ug/L	1	ND	0.5	24	ND	0.5	1	ND	0.5	--	--	--	--	--	--	--	--
Carbon Tetrachloride	ug/L	13	ND	0.5	114	ND	0.5	8	ND	0.5	18	ND	0.5	57	ND	0.5	0.5	--
Chloroethane	ug/L	13	ND	0.5	50	ND	0.5	7	ND	0.5	18	ND	0.5	20	ND	0.5	--	--
Chloroform (THM)	ug/L	13	ND	1	63	**D**	1	7	ND	1	18	**D**	0.5	20	ND	1	--	--
Chloromethane	ug/L	13	ND	0.5	50	ND	0.5	7	ND	0.5	18	ND	0.5	20	ND	0.5	--	--
cis-1,2-Dichloroethene	ug/L	13	ND	0.5	114	ND	0.5	8	ND	0.5	18	ND	0.5	57	ND	0.5	6	--
Di(2-Ethylhexyl) Adipate	ug/L	2	ND	5	45	ND	5	4	ND	5	--	--	--	8	ND	5	400	--
Di(2-Ethylhexyl) Phthalate	ug/L	2	ND	3	45	ND	3	4	ND	3	--	--	--	8	ND	3	4	--
Dibromoacetic Acid (DBAA)	ug/L	--	--	--	--	--	--	--	--	--	2	ND	1	2	ND	1	--	--
Dibromochloroacetic Acid (CDBAA)	ug/L	--	--	--	--	--	--	--	--	--	1	ND	2	1	ND	2	--	--
Dibromochloromethane (THM)	ug/L	13	ND	1	63	**D**	1	7	ND	1	18	ND	0.5	20	ND	1	--	--
Dibromochloropropane (DBCP)	ug/L	2	ND	0.01	46	ND	0.01	3	ND	0.01	--	--	--	12	ND	0.01	0.2	--
Dibromomethane	ug/L	13	ND	0.5	51	ND	0.5	7	ND	0.5	18	ND	0.5	20	ND	0.5	--	--
Dichloroacetic Acid (DCAA)	ug/L	--	--	--	--	--	--	--	--	--	2	ND	1	2	ND	1	--	--
Dichlorodifluoromethane (Freon 12)	ug/L	13	ND	0.5	63	**D**	0.5	7	ND	0.5	18	ND	0.5	20	ND	0.5	--	--
Dichloromethane	ug/L	13	ND	0.5	114	ND	0.5	8	ND	0.5	18	ND	0.5	57	ND	0.5	5	--
Diisopropyl Ether	ug/L	13	ND	3	51	ND	3	7	ND	3	18	ND	2	20	ND	3	--	--
Ethylbenzene	ug/L	13	ND	0.5	114	ND	0.5	8	ND	0.5	18	ND	0.5	57	ND	0.5	300	--
Ethylene Dibromide (EDB)	ug/L	2	ND	0.02	--	--	--	3	ND	0.02	--	--	--	12	ND	0.02	0.05	--
Ethylenediamine Tetra-Acetic Acid	mg/L	--	--	--	--	--	--	--	--	--	2	ND	0.1	2	ND	0.1	--	--
Ethyl-Tert-Butyl Ether	ug/L	13	ND	3	63	ND	3	7	ND	3	18	ND	2	20	ND	3	--	--
Hexachlorobutadiene	ug/L	13	ND	0.5	63	ND	0.5	7	ND	0.5	18	ND	0.5	20	ND	0.5	--	--
Isopropylbenzene	ug/L	13	ND	0.5	63	ND	0.5	7	ND	0.5	18	ND	0.5	20	ND	0.5	--	--
m,p-Xylene	ug/L	13	ND	0.5	69	ND	0.5	7	ND	0.5	18	ND	0.5	20	ND	0.5	--	--
Methyl Ethyl Ketone (MEK, Butanone)	ug/L	1	ND	0.5	28	ND	5	2	ND	5	--	--	--	1	ND	5	--	--
Methyl Isobutyl Ketone	ug/L	1	ND	0.5	41	ND	5	2	ND	5	--	--	--	1	ND	5	--	--
Methyl Tert-Butyl Ether (MTBE)	ug/L	13	ND	3	119	ND	3	8	ND	3	18	ND	2	57	ND	3	13	5

Table C-3 Summary of 2019 Volatile Organic Compound (VOC) Data (Detect/Non-Detect)

Parameter	Units[1]	Santa Clara Subbasin, Santa Clara Plain						Santa Clara Subbasin, Coyote Valley			Llagas Subbasin						Maximum Contaminant Level	
		Shallow Zone[2]			Principal Zone[3]						Shallow Zone			Principal Zone				
		n[4]	Result[5]	RL[6]	n	Result	RL	n	Result	RL	n	Result	RL	n	Result	RL	MCL[7]	SMCL[8]
Monobromoacetic Acid (MBAA)	ug/L	--	--	--	--	--	--	--	--	--	2	ND	1	2	ND	1	--	--
Monochloroacetic Acid (MCAA)	ug/L	--	--	--	--	--	--	--	--	--	2	ND	2	2	ND	2	--	--
Monochlorobenzene	ug/L	13	ND	0.5	114	ND	0.5	8	ND	0.5	18	ND	0.5	57	ND	0.5	70	--
Naphthalene	ug/L	13	ND	0.5	63	ND	0.5	7	ND	0.5	18	ND	0.5	20	ND	0.5	--	--
n-Butylbenzene	ug/L	13	ND	0.5	63	ND	0.5	7	ND	0.5	18	ND	0.5	20	ND	0.5	--	--
N-Ethyl Perfluorooctanesulfonamidoacetic Acid	ng/L	--	--	--	98	ND	3	--	--	--	--	--	--	--	--	--	--	--
Nitrilotriacetic Acid (NTA)	mg/L	--	--	--	--	--	--	--	--	--	2	ND	0.1	2	ND	0.1	--	--
N-Methyl Perfluorooctanesulfonamidoacetic Acid	ng/L	--	--	--	98	ND	3	--	--	--	--	--	--	--	--	--	--	--
n-Nitrosodiethylamine (NDEA)	ng/L	--	--	--	--	--	--	--	--	--	2	ND	2	2	ND	2	--	--
n-Nitrosodimethylamine (NDMA)	ng/L	--	--	--	--	--	--	--	--	--	2	ND	2	2	ND	2	--	--
n-Nitrosodi-n-Butylamine (NDBA)	ng/L	--	--	--	--	--	--	--	--	--	2	ND	2	2	ND	2	--	--
n-Nitrosodi-n-Propylamine (NDPA)	ng/L	--	--	--	--	--	--	--	--	--	2	ND	2	2	ND	2	--	--
n-Nitrosomethylethylamine (NMEA)	ng/L	--	--	--	--	--	--	--	--	--	2	ND	2	2	ND	2	--	--
n-Nitrosomorpholine (NMOR)	ng/L	--	--	--	--	--	--	--	--	--	1	ND	2	1	ND	2	--	--
n-Nitrosopiperidine (NPIP)	ng/L	--	--	--	--	--	--	--	--	--	1	ND	2	1	ND	2	--	--
n-Nitrosopyrrolidine (NPYR)	ng/L	--	--	--	--	--	--	--	--	--	2	ND	2	2	ND	2	--	--
o-Xylene	ug/L	13	ND	0.5	69	ND	0.5	7	ND	0.5	18	ND	0.5	20	ND	0.5	--	--
PCB-1016	ug/L	2	ND	0.5	47	ND	0.5	3	ND	0.5	--	--	--	8	ND	0.5	--	--
PCB-1221	ug/L	2	ND	0.5	47	ND	0.5	3	ND	0.5	--	--	--	8	ND	0.5	--	--
PCB-1232	ug/L	2	ND	0.5	47	ND	0.5	3	ND	0.5	--	--	--	8	ND	0.5	--	--
PCB-1242	ug/L	2	ND	0.5	47	ND	0.5	3	ND	0.5	--	--	--	8	ND	0.5	--	--
PCB-1248	ug/L	2	ND	0.5	47	ND	0.5	3	ND	0.5	--	--	--	8	ND	0.5	--	--
PCB-1254	ug/L	2	ND	0.5	47	ND	0.5	3	ND	0.5	--	--	--	8	ND	0.5	--	
PCB-1260	ug/L	2	ND	0.5	47	ND	0.5	3	ND	0.5	--	--	--	8	ND	0.5	--	--
Perfluorobutanoic acid (PFBA)	ng/L	--	--	--	--	--	--	--	--	--	1	ND	100	1	ND	10	--	--
Perfluorobutanesulfonic acid (PFBS)	ng/L	--	--	--	98	**D**	2	--	--	--	1	ND	4.1	1	ND	4.3	--	--
Perfluorodecanoic acid (PFDA)	ng/L	--	--	--	98	ND	3	--	--	--	--	--	--	--	--	--	--	--
Perfluorododecanoic acid (PFDoA)	ng/L	--	--	--	98	ND	3	--	--	--	--	--	--	--	--	--	--	--
Perfluoroheptanoic acid (PFHPA)	ng/L	--	--	--	98	**D**	3	--	--	--	--	--	--	--	--	--	--	--
Perfluorohexane Sulfonic acid (PFHxS)	ng/L	--	--	--	98	**D**	3	--	--	--	--	--	--	--	--	--	--	--

Table C-3 Summary of 2019 Volatile Organic Compound (VOC) Data (Detect/Non-Detect)

Parameter	Units[1]	Santa Clara Subbasin, Santa Clara Plain						Santa Clara Subbasin, Coyote Valley			Llagas Subbasin						Maximum Contaminant Level	
		Shallow Zone[2]			Principal Zone[3]						Shallow Zone			Principal Zone				
		n[4]	Result[5]	RL[6]	n	Result	RL	n	Result	RL	n	Result	RL	n	Result	RL	MCL[7]	SMCL[8]
Perfluorohexanoic acid (PFHxA)	ng/L	--	--	--	98	**D**	3	--	--	--	--	--	--	--	--	--	--	--
Perfluorononanoic acid (PFNA)	ng/L	--	--	--	98	**D**	3	--	--	--	--	--	--	--	--	--	--	--
Perfluorooctanoic acid (PFOA)	ng/L	--	--	--	98	**D**	3	--	--	--	2	**D**	1.6	2	ND	5	--	--
Perfluorooctyl Sulfonate (PFOS)	ng/L	--	--	--	98	**D**	3	--	--	--	2	**D**	5	2	ND	5	--	--
Perfluorotetradecanoic acid (PFTA)	ng/L	--	--	--	98	ND	3	--	--	--	--	--	--	--	--	--	--	--
Perfluorotridecanoic acid (PFTrDA)	ng/L	--	--	--	98	ND	3	--	--	--	--	--	--	--	--	--	--	--
Perfluoroundecanoic acid (PFUnA)	ng/L	--	--	--	98	ND	3	--	--	--	--	--	--	--	--	--	--	--
p-Isopropyltoluene	ug/L	13	ND	0.5	46	ND	0.5	6	ND	0.5	18	ND	0.5	19	ND	0.5	--	--
Polychlorinated Biphenyls (Total PCBs)	ug/L	2	ND	0.5	47	ND	0.5	3	ND	0.5	--	--	--	11	ND	0.5	0.5	--
sec-Butylbenzene	ug/L	13	ND	0.5	63	ND	0.5	7	ND	0.5	18	ND	0.5	20	ND	0.5	--	--
Styrene	ug/L	13	ND	0.5	114	ND	0.5	8	ND	0.5	18	ND	0.5	57	ND	0.5	100	--
Tert-Amyl Methyl Ether (TAME)	ug/L	13	ND	3	63	ND	3	7	ND	3	18	ND	2	20	ND	3	--	--
Tert-Butyl Alcohol (TBA)	ug/L	12	ND	2	22	ND	2	6	ND	2	18	ND	2	19	ND	2	--	--
Tert-Butylbenzene	ug/L	13	ND	0.5	63	ND	0.5	7	ND	0.5	18	ND	0.5	20	ND	0.5	--	--
Tetrachloroethene	ug/L	13	**D**	0.5	114	ND	0.5	8	ND	0.5	18	ND	0.5	57	**D**	0.5	5	--
Toluene	ug/L	13	ND	0.5	114	ND	0.5	8	ND	0.5	18	ND	0.5	57	ND	0.5	150	--
Total Trihalomethanes	ug/L	1	ND	0.5	31	**D**	0.5	1	ND	0.5	--	--	--	--	--	--	80	--
trans-1,2,Dichloroethene	ug/L	13	ND	0.5	114	ND	0.5	8	ND	0.5	18	ND	0.5	57	ND	0.5	10	--
Tribromoacetic Acid (TBAA)	ug/L	--	--	--	--	--	--	--	--	--	2	ND	4	2	ND	4	--	--
Trichloroacetic Acid (TCAA)	ug/L	--	--	--	--	--	--	--	--	--	2	ND	1	2	ND	1	--	--
Trichloroethene	ug/L	13	ND	0.5	114	**D**	0.5	8	ND	0.5	18	ND	0.5	57	ND	0.5	5	--
Trichlorofluoromethane (Freon 11)	ug/L	13	ND	5	114	ND	5	8	ND	5	18	ND	2.5	57	ND	5	150	--
Vinyl Chloride	ug/L	13	ND	0.5	114	ND	0.5	8	ND	0.5	18	ND	0.5	57	ND	0.5	0.5	--
Xylenes (Total)	ug/L	13	ND	0.5	114	ND	0.5	8	ND	0.5	18	ND	0.5	57	ND	0.5	1,750	--

Notes:
Table includes data for wells monitored by Valley Water (annual monitoring network wells and water supply wells) and public water system data reported to the CA Division of Drinking Water (DDW).
Only wells with known construction information are presented. Unless construction is known, DDW wells are assumed to represent the principal zone, as these are typically deep wells.

1. ug/L = micrograms per liter.
2. The shallow aquifer zone is represented by wells primarily drawing water from depths less than 150 feet.
3. The principal aquifer zone is represented by wells primarily drawing water from depths greater than 150 feet.
4. n = number of results for each parameter. Some parameters may have been analyzed more than once at a particular well.
5. ND= not detected above laboratory reporting limit in any samples. D = detection above reporting limit in one or more samples (see Table C-4 for more information).
6. RL = Laboratory reporting limit. In the case of multiple reporting limits, the highest limit is shown. NA is shown if the reporting limit is not available.
7. MCL = Maximum Contaminant Level specified in Title 22 of the California Code of Regulations. The MCL is a health-based drinking water standard.
8. SMCL = Secondary Maximum Contaminant Level, or aesthetic-based standard, per DDW or US EPA.

Table C-4 Summary of 2019 Volatile Organic Compounds (VOCs) Detections

Parameter	Units[1]	Santa Clara Subbasin, Santa Clara Plain								Santa Clara Subbasin, Coyote Valley				Llagas Subbasin								Maximum Contaminant Level	
		Shallow Zone[2]				Principal Zone[3]								Shallow Zone				Principal Zone					
		n[4]	Min[5]	Median[6]	Max	n	Min	Median	Max	n	Min	Median	Max	n	Min	Median	Max	n	Min	Median	Max	MCL[7]	SMCL[8]
1,1,1-Trichloroethane	ug/L	13	<0.5	<0.5	0.9	115	<0.5	<0.5	2.4	8	<0.5	<0.5	<0.5	18	<0.5	<0.5	<0.5	57	<0.5	<0.5	<0.5	200	--
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	ug/L	13	<2	<2	2.4	114	<0.5	<2	3.3	8	<2	<2	<10	18	<2	<2	<2	57	<2	<2	<10	1,200	--
1,1-Dichloroethene	ug/L	13	<0.5	<0.5	<0.5	114	<0.5	<0.5	4.6	8	<0.5	<0.5	<0.5	18	<0.5	<0.5	<0.5	57	<0.5	<0.5	<0.5	6	--
Bromodichloromethane (THM)	ug/L	13	<0.5	<0.5	<1	63	<0.5	<1	2.2	7	<0.5	<0.5	<1	18	<0.5	<0.5	<0.5	20	<0.5	<0.5	<1	--	--
Bromoform (THM)	ug/L	13	<0.5	<0.5	<1	63	<0.5	<1	1	7	<0.5	<0.5	<1	18	<0.5	<0.5	<0.5	20	<0.5	<0.5	0.94	--	--
Chloroform (THM)	ug/L	13	<0.5	<0.5	<1	63	<0.5	<1	1.1	7	<0.5	<0.5	<1	18	<0.5	<0.5	6.9	20	<0.5	<0.5	<1	--	--
Dibromochloromethane (THM)	ug/L	13	<0.5	<0.5	<1	63	<0.5	<1	2.8	7	<0.5	<0.5	<1	18	<0.5	<0.5	<0.5	20	<0.5	<0.5	<1	--	--
Dichlorodifluoromethane (Freon 12)	ug/L	13	<0.5	<0.5	<0.5	63	<0.5	<0.5	5	7	<0.5	<0.5	<0.5	18	<0.5	<0.5	<0.5	20	<0.5	<0.5	<0.5	--	--
Perfluorobutanesulfonic acid (PFBS)	ng/L	--	--	--	--	98	<1	<2	3.8	--	--	--	--	1	<4.1	<4.1	<4.1	1	<4.3	<4.3	<4.3	--	--
Perfluoroheptanoic acid (PFHPA)	ng/L	--	--	--	--	98	<1	<2	2.3	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Perfluorohexane Sulfonic acid (PFHxS)	ng/L	--	--	--	--	98	<1.7	2.2	8.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Perfluorohexanoic acid (PFHxA)	ng/L	--	--	--	--	98	<0.88	<2	3.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Perfluorononanoic acid (PFNA)	ng/L	--	--	--	--	98	<0.88	<2	5.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Perfluorooctanoic acid (PFOA)	ng/L	--	--	--	--	98	<0.88	<2	3.4	--	--	--	--	2	6.9	8.1	9.3	2	<1.7	<5	<5	--	--
Perfluorooctyl Sulfonate (PFOS)	ng/L	--	--	--	--	98	<0.89	0.89	8.2	--	--	--	--	2	2.2	2.2	2.2	2	<1.7	<5	<5	--	--
Tetrachloroethene	ug/L	13	<0.5	<0.5	0.8	114	<0.5	<0.5	<0.5	8	<0.5	<0.5	<0.5	18	<0.5	<0.5	<0.5	57	<0.5	<0.5	2.4	5	--
Total Trihalomethanes	ug/L	1	<0.5	<0.5	<0.5	31	<0.5	<0.5	7.1	1	<0.5	<0.5	<0.5	--	--	--	--	--	--	--	--	80	--
Trichloroethene	ug/L	13	<0.5	<0.5	<0.5	114	<0.5	<0.5	0.7	8	<0.5	<0.5	<0.5	18	<0.5	<0.5	<0.5	57	<0.5	<0.5	<0.5	5	--

Notes:

Table includes data for wells monitored by Valley Water (annual monitoring network wells and water supply wells) and public water system data reported to the CA Division of Drinking Water (DDW). The table does not include results from wells sampled near recycled water irrigation sites, which are included in Appendix E.

Only wells with known construction information are presented in this table. DDW wells are assumed to represent the principal zone if no construction information is available, as these are typically deep wells.

1. ug/L = micrograms per liter; ng/L = nanograms per liter.
2. The shallow aquifer zone is represented by wells primarily drawing water from depths less than 150 feet.
3. The principal aquifer zone is represented by wells primarily drawing water from depths greater than 150 feet.
4. n = number of results for each parameter. Some parameters may have been analyzed more than once at a particular well.
5. The minimum shown is the lowest detected value. The lowest reporting limit (e.g., <5) is shown when there are no quantified values at the lowest reporting limit.
6. For parameters with results with multiple reporting limits, the median was computed using the Maximum Likelihood Estimate method.
7. MCL = Maximum Contaminant Level specified in Title 22 of the California Code of Regulations. The MCL is a health-based drinking water standard.
8. SMCL = Secondary Maximum Contaminant Level, or aesthetic-based standard, per DDW or US EPA.
9. Verification sampling did not confirm the high 1,2,3-Trichloropropane result. All subsequent results were below the detection level (0.005 ppb).

Table C-5 Summary of 2019 Pesticide Data (Detect/Non-Detect)

Parameter	Units[1]	Santa Clara Subbasin, Santa Clara Plain						Santa Clara Subbasin, Coyote Valley			Llagas Subbasin						Maximum Contaminant Level	
		Shallow Zone[2]			Principal Zone[3]						Shallow Zone			Principal Zone				
		n[4]	Result[5]	RL[6]	n	Result	RL	n	Result	RL	n	Result	RL	n	Result	RL	MCL[7]	SMCL[8]
2,3,7,8-TCDD (Dioxin)	pg/L	2	ND	5	46	ND	5	3	ND	5	--	--	--	8	ND	5	30	--
2,4,5-TP (Silvex)	ug/L	--	--	--	48	ND	1	3	ND	1	--	--	--	8	ND	1	50	--
2,4-D	ug/L	2	ND	10	48	ND	10	3	ND	10	--	--	--	8	ND	10	70	--
3-Hydroxycarbofuran	ug/L	2	ND	3	42	ND	3	3	ND	3	--	--	--	2	ND	3	--	--
Aciflurfen	ug/L	--	--	--	6	ND	0.5	--	--	--	--	--	--	--	--	--	--	--
Alachlor	ug/L	2	ND	1	55	ND	1	6	ND	1	--	--	--	9	ND	1	2	--
Aldicarb	ug/L	2	ND	3	42	ND	3	3	ND	3	--	--	--	2	ND	3	--	--
Aldicarb Sulfone	ug/L	2	ND	4	42	ND	4	3	ND	4	--	--	--	2	ND	4	--	--
Aldicarb Sulfoxide	ug/L	2	ND	3	42	ND	3	3	ND	3	--	--	--	2	ND	3	--	--
Aldrin	ug/L	2	ND	0.08	42	ND	0.08	2	ND	0.08	--	--	--	1	ND	0.08	--	--
Atrazine	ug/L	2	ND	0.5	48	ND	0.5	5	ND	0.5	--	--	--	9	ND	0.5	1	--
Bentazon	ug/L	2	ND	2	48	ND	2	3	ND	2	--	--	--	8	ND	2	18	--
Bromacil	ug/L	2	ND	10	39	ND	10	3	ND	10	--	--	--	--	--	--	--	--
Butachlor	ug/L	2	ND	0.38	39	ND	0.38	3	ND	0.38	--	--	--	--	--	--	--	--
Carbaryl	ug/L	2	ND	5	42	ND	5	3	ND	5	--	--	--	2	ND	5	--	--
Carbofuran	ug/L	2	ND	5	48	ND	5	4	ND	5	--	--	--	12	ND	5	18	--
Chlordane	ug/L	2	ND	0.1	47	ND	0.1	3	ND	0.1	--	--	--	11	ND	0.1	0.1	--
Dalapon	ug/L	2	ND	10	47	ND	10	3	ND	10	--	--	--	8	ND	10	200	--
DCPA (Total Di & Mono Acid Degradates)	ug/L	2	ND	0.1	38	ND	0.1	2	ND	0.1	--	--	--	--	--	--	--	--
Diazinon	ug/L	2	ND	0.1	38	ND	0.1	2	ND	0.1	--	--	--	--	--	--	--	--
Dicamba	ug/L	2	ND	1.5	48	ND	1.5	3	ND	1.5	--	--	--	4	ND	1.5	--	--
Dieldrin	ug/L	2	ND	0.02	41	ND	0.02	2	ND	0.02	--	--	--	1	ND	0.02	--	--
Dimethoate	ug/L	2	ND	0.1	38	ND	0.1	2	ND	0.1	--	--	--	--	--	--	--	--
Dinoseb	ug/L	2	ND	2	48	ND	2	3	ND	2	--	--	--	8	ND	2	7	--
Diquat	ug/L	1	ND	4	36	ND	4	3	ND	4	--	--	--	--	--	--	20	--
Endothall	ug/L	2	ND	45	47	ND	45	4	ND	45	--	--	--	11	ND	45	100	--
Endrin	ug/L	2	ND	0.1	47	ND	0.1	3	ND	0.1	--	--	--	11	ND	0.1	2	--
gamma-BHC (lindane)	ug/L	2	ND	0.2	54	ND	0.2	4	ND	0.2	--	--	--	11	ND	0.2	0.2	--
Glyphosate	ug/L	2	ND	25	46	ND	25	4	ND	25	--	--	--	14	ND	25	700	--
Heptachlor	ug/L	2	ND	0.01	47	ND	0.01	3	ND	0.01	--	--	--	11	ND	0.01	0.01	--
Heptachlor Epoxide	ug/L	2	ND	0.01	47	ND	0.01	3	ND	0.01	--	--	--	11	ND	0.01	0.01	--
Hexachlorobenzene	ug/L	2	ND	0.5	47	ND	0.5	--	--	--	--	--	--	11	ND	0.5	1	--

Table C-5 Summary of 2019 Pesticide Data (Detect/Non-Detect)

Parameter	Units[1]	Santa Clara Subbasin, Santa Clara Plain						Santa Clara Subbasin, Coyote Valley			Llagas Subbasin						Maximum Contaminant Level	
		Shallow Zone[2]			Principal Zone[3]						Shallow Zone			Principal Zone				
		n[4]	Result[5]	RL[6]	n	Result	RL	n	Result	RL	n	Result	RL	n	Result	RL	MCL[7]	SMCL[8]
Hexachlorocyclopentadiene	ug/L	2	ND	1	47	ND	1	3	ND	1	--	--	--	11	ND	1	50	--
Methiocarb	ug/L	2	ND	0.5	41	ND	0.5	2	ND	0.5	--	--	--	--	--	--	--	--
Methomyl	ug/L	2	ND	2	--	--	--	3	ND	2	--	--	--	2	ND	2	--	--
Methoxychlor	ug/L	2	ND	10	54	ND	10	4	ND	10	--	--	--	11	ND	10	30	--
Metolachlor	ug/L	2	ND	0.05	38	ND	0.05	2	ND	0.05	--	--	--	--	--	--	--	--
Metribuzin	ug/L	2	ND	0.05	38	ND	0.06	2	ND	0.05	--	--	--	--	--	--	--	--
Molinate	ug/L	2	ND	2	48	ND	2	4	ND	2	--	--	--	8	ND	2	20	--
Oxamyl	ug/L	2	ND	20	48	ND	20	4	ND	20	--	--	--	12	ND	20	50	--
Pentachlorophenol	ug/L	2	ND	0.2	48	ND	0.2	3	ND	0.2	--	--	--	8	ND	0.2	1	--
Picloram	ug/L	2	ND	1	48	ND	1	3	ND	1	--	--	--	8	ND	1	500	--
Propachlor	ug/L	2	ND	0.5	39	ND	0.5	3	ND	0.5	--	--	--	--	--	--	--	--
Propoxur	ug/L	2	ND	0.5	41	ND	0.5	2	ND	0.5	--	--	--	--	--	--	--	--
Simazine	ug/L	2	ND	1	48	ND	1	5	ND	1	--	--	--	9	ND	1	4	--
Terbacil	ug/L	--	--	--	2	ND	0.1	--	--	--	--	--	--	--	--	--	--	--
Terbuthylazine	ug/L	--	--	--	--	--	--	--	--	--	2	ND	0.1	2	ND	0.1	--	--
Thiobencarb	ug/L	2	ND	1	50	ND	1	4	ND	1	--	--	--	8	ND	1	70	1
Toxaphene	ug/L	2	ND	1	47	ND	1	3	ND	1	--	--	--	11	ND	1	3	--

Notes:
Table includes data for wells monitored by Valley Water (annual monitoring network wells and water supply wells) and public water system data reported to the CA Division of Drinking Water (DDW).
Only wells with known construction information are presented in this table. DDW wells are assumed to represent the principal zone if no construction information is available, as these are typically deep wells.

1. ug/L = micrograms per liter.
2. The shallow aquifer zone is represented by wells primarily drawing water from depths less than 150 feet.
3. The principal aquifer zone is represented by wells primarily drawing water from depths greater than 150 feet.
4. n = number of results for each parameter. Some parameters may have been analyzed more than once at a particular well.
5. ND= not detected above laboratory reporting limit in any samples.
6. RL = Laboratory reporting limit. In the case of multiple reporting limits, the highest limit is shown. NA is shown if the reporting limit is not available.
7. MCL = Maximum Contaminant Level specified in Title 22 of the California Code of Regulations. The MCL is a health-based drinking water standard.
8. SMCL = Secondary Maximum Contaminant Level, or aesthetic-based standard, per DDW or US EPA

Table C-6 Summary of 2019 Pesticide Detections

Notes:
No pesticides were detected at concentrations above respective method reporting limits.
Table includes data for wells monitored by Valley Water (annual monitoring network wells and water supply wells) and public water system data reported to the CA Division of Drinking Water (DDW).
Only wells with known construction information are presented in this table. DDW wells are assumed to represent the principal zone if no construction information is available, as these are typically deep wells.

1. -- = no value available.
2. The shallow aquifer zone is represented by wells primarily drawing water from depths less than 150 feet.
3. The principal aquifer zone is represented by wells primarily drawing water from depths greater than 150 feet.
4. n = number of results for each parameter. Some parameters may have been analyzed more than once at a particular well.
5. The minimum shown is the lowest detected value. The lowest reporting limit (e.g., <0.1) is shown when there are no quantified values at the lowest reporting limit.
6. For parameters with results with multiple reporting limits, the median was computed using the Maximum Likelihood Estimate method.
7. MCL = Maximum Contaminant Level specified in Title 22 of the California Code of Regulations. The MCL is a health-based drinking water standard.
8. SMCL = Secondary Maximum Contaminant Level, or aesthetic-based standard, per DDW or US EPA.

Table C-7 Summary of 2019 Radioactive Data

Parameter	Units[1]	Santa Clara Subbasin, Santa Clara Plain								Santa Clara Subbasin, Coyote Valley				Llagas Subbasin								Maximum Contaminant Levels	
		Shallow Zone[2]				Principal Zone[3]								Shallow Zone				Principal Zone					
		n[4]	Min[5]	Median[6]	Max	n	Min	Median	Max	n	Min	Median	Max	n	Min	Median	Max	n	Min	Median	Max	MCL[7]	SMCL[8]
Gross Alpha	pCi/L	--	--	--	--	17	<3	0.81	6.5	--	--	--	--	--	--	--	--	9	<3	1.5	3.25	15	--
Gross Beta	pCi/L	--	--	--	--	10	<4	<4	<4	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Radium 226	pCi/L	--	--	--	--	4	0.06	0.06	0.06	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Radium 228	pCi/L	--	--	--	--	5	0.45	0.45	0.45	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Strontium-90	pCi/L	--	--	--	--	1	0.14	0.14	0.14	--	--	--	--	--	--	--	--	--	--	--	--	8	--
Tritium	pCi/L	--	--	--	--	1	<1,000	<1,000	<1,000	--	--	--	--	--	--	--	--	--	--	--	--	20,000	--
Uranium	pCi/L	--	--	--	--	4	<1	<1	<1	--	--	--	--	--	--	--	--	--	--	--	--	20	--

Notes:

Table includes data for wells monitored by Valley Water (annual monitoring network wells and water supply wells) and public water system data reported to the CA Division of Drinking Water (DDW).

Only wells with known construction information are presented in this table. DDW wells are assumed to represent the principal zone if no construction information is available, as these are typically deep wells.

1. pCi/L = picocuries per liter; mrem/yr = millirem per year.
2. The shallow aquifer zone is represented by wells primarily drawing water from depths less than 150 feet.
3. The principal aquifer zone is represented by wells primarily drawing water from depths greater than 150 feet.
4. n = number of results for each parameter. Some parameters may have been analyzed more than once at a particular well.
5. The minimum shown is the lowest detected value. The lowest reporting limit (e.g., <5) is shown when there are no quantified values at the lowest reporting limit.
6. For parameters with results with multiple reporting limits, the median was computed using the Maximum Likelihood Estimate (MLE) method.
7. MCL = Maximum Contaminant Level specified in Title 22 of the California Code of Regulations. The MCL is a health-based drinking water standard.
8. SMCL = Secondary Maximum Contaminant Level, or aesthetic-based standard, per DDW or US EPA.

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APPENDIX D

2019 Recharge Water Quality Results

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Table D-1 Summary of 2019 Recharge Water Quality Indicator Data

Parameter	Units	Recharge System											
		Coyote				Los Gatos				Westside			
		n	Min	Median	Max	n	Min	Median	Max	n	Min	Median	Max
Water Quality Indicators													
Bicarbonate Alkalinity (as CaCO3)	mg/L	12	148	213	259	12	112	149	154	6	233	250	265
Oxidation Reduction Potential (ORP)	mV	18	33	143	249	18	52	133	213	9	149	175	190
pH, Field	pH Units	18	7.52	7.79	8.19	18	7.4	8.0	8.6	9	7.0	7.7	7.9
Source Temperature	C	18	18.5	22.7	25.2	18	18	23	27	9	14	17	72
Specific Conductance, Field	uS/cm	18	277	533	692	18	273	316	441	9	431	486	517
Turbidity, Field	NTU	18	2.74	11.2	29.9	18	2.3	3.6	12	9	29	47	67
Total Alkalinity (as CaCO3)	mg/L	18	121	176	213	18	106	122	129	9	191	208	217
Major and Minor Ions													
Bicarbonate (as HCO3)	mg/L	6	150	212	249	6	101	145	148	3	259	263	264
Boron	ug/L	12	82	113	135	12	<50	58	79	6	100	109	124
Bromide	mg/L	18	<0.1	<0.1	0.15	18	<0.1	<0.1	<0.1	9	<0.1	<0.1	<0.1
Calcium (Dissolved)	mg/L	18	31	48	54	18	21	34	38	9	62	65	68
Chloride	mg/L	18	14	33	49	18	9	11	34	9	15	18	21
Fluoride (natural source)	mg/L	18	0.11	0.15	0.26	18	0.11	0.16	0.25	9	0.14	0.15	0.19
Magnesium (Dissolved)	mg/L	18	14	26	39	18	12	14	16	9	19	21	23
Potassium (Dissolved)	mg/L	18	1.4	1.7	2.1	18	1.2	1.9	2.2	9	1.4	1.5	1.5
Silica	mg/L	12	11	15	18	12	8	14	16	6	18	19	19
Sodium (Dissolved)	mg/L	18	17	26	37	18	12	17	28	9	16	18	20
Sulfate	mg/L	18	31	51.0	54	18	31	32	37	9	34	36	39
Total Dissolved Solids (TDS)	mg/L	18	106	289	390	18	184	202	240	9	296	322	340

Notes:

1. n = number of samples
2. mg/L = milligrams per liter;ug/L = micrograms per liter; mV = millivolts; C = Celsisus; uS/cm = microsiemens per centimeter; NTU = Nephelometric Turbidity Units;

Table D-2 Summary of 2019 Recharge Water Quality Trace Metals Data

Parameter	Units	Recharge System											
		Coyote				Los Gatos				Westside			
		n	Min	Median	Max	n	Min	Median	Max	n	Min	Median	Max
Aluminum (Dissolved)	ug/L	18	<20	<20	28	18	<20	<20	24	9	<20	<20	<20
Antimony (Dissolved)	ug/L	18	<1	<1	<1	18	<1	<1	<1	9	<1	<1	<1
Arsenic (Dissolved)	ug/L	18	<2	<2	3	18	<2	<2	3	9	<2	<2	2
Barium (Dissolved)	ug/L	18	57	83	110	18	34	42	52	9	91	104	110
Beryllium (Dissolved)	ug/L	18	<1	<1	<1	18	<1	<1	<1	9	<1	<1	<1
Cadmium (Dissolved)	ug/L	18	<1	<1	<1	18	<1	<1	<1	9	<1	<1	<1
Chromium (Dissolved)	ug/L	18	<1	<1	<1	18	<1	<1	<1	9	<1	<1	<1
Cobalt	ug/L	12	<1	<1	<1	12	<1	<1	<1	6	<1	<1	<1
Copper (Dissolved)	ug/L	18	1	1.3	1.9	18	<1	1.5	3.2	9	<1	<1	1.3
Iron (Dissolved)	ug/L	18	<20	<20	<20	18	<20	<20	26	9	<20	<20	<20
Lead (Dissolved)	ug/L	18	<1	<1	<1	18	<1	<1	<1	9	<1	<1	<1
Lithium (Dissolved)	ug/L	18	6.7	9.7	11	18	<5	5.3	6.1	9	6.3	6.7	7.0
Manganese (Dissolved)	ug/L	18	<1	3.8	17	18	<1	1.5	5.7	9	<1	3.8	33
Mercury (Dissolved)	ug/L	18	<1	<1	<1	18	<1	<1	<1	9	<1	<1	<1
Molybdenum (Dissolved)	ug/L	18	<1	<1	1.7	18	<1	1.3	1.5	9	1.6	1.8	2.2
Nickel (Dissolved)	ug/L	18	1.8	2.1	2.7	18	<1	<1	1.2	9	<1	1.1	1.3
Selenium (Dissolved)	ug/L	18	<5	<5	<5	18	<5	<5	<5	9	<5	<5	<5
Silver (Dissolved)	ug/L	18	<1	<1	<1	18	<1	<1	<1	9	<1	<1	<1
Thallium (Dissolved)	ug/L	18	<1	<1	<1	18	<1	<1	<1	9	<1	<1	<1
Vanadium (Dissolved)	ug/L	18	1.5	2.0	3.2	18	1.6	1.9	7.2	9	2.1	2.2	2.3
Zinc (Dissolved)	ug/L	18	<10	<10	<10	18	<10	<10	<10	9	<10	<10	<10

Notes:
1. n = number of samples
2. ug/L = micrograms per liter

Table D-3 Summary of 2019 Recharge Water Quality Volatile Organic Compounds Data

Parameter	Units	Recharge System							
		Coyote				Westside			
		n	Min	Median	Max	n	Min	Median	Max
1,1,1,2-Tetrachlorethane	ug/L	9	<0.5	<0.5	<0.5	3	<0.5	<0.5	<0.5
1,1,1-Trichloroethane	ug/L	9	<0.5	<0.5	<0.5	3	<0.5	<0.5	<0.5
1,1,2,2-Tetrachloroethane	ug/L	9	<0.5	<0.5	<0.5	3	<0.5	<0.5	<0.5
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	ug/L	9	<2	<2	<2	3	<2	<2	<2
1,1,2-Trichloroethane	ug/L	9	<0.5	<0.5	<0.5	3	<0.5	<0.5	<0.5
1,1-Dichloroethane	ug/L	9	<0.5	<0.5	<0.5	3	<0.5	<0.5	<0.5
1,1-Dichloroethene	ug/L	9	<0.5	<0.5	<0.5	3	<0.5	<0.5	<0.5
1,1-Dichloropropene	ug/L	9	<0.5	<0.5	<0.5	3	<0.5	<0.5	<0.5
1,2,3-Trichlorobenzene	ug/L	9	<0.5	<0.5	<0.5	3	<0.5	<0.5	<0.5
1,2,3-Trichloropropane	ug/L	9	<0.5	<0.5	<0.5	3	<0.5	<0.5	<0.5
1,2,4-Trichlorobenzene	ug/L	9	<0.5	<0.5	<0.5	3	<0.5	<0.5	<0.5
1,2,4-Trimethylbenzene	ug/L	9	<0.5	<0.5	<0.5	3	<0.5	<0.5	<0.5
1,2-Dichlorobenzene	ug/L	9	<0.5	<0.5	<0.5	3	<0.5	<0.5	<0.5
1,2-Dichloroethane	ug/L	9	<0.5	<0.5	<0.5	3	<0.5	<0.5	<0.5
1,2-Dichloropropane	ug/L	9	<0.5	<0.5	<0.5	3	<0.5	<0.5	<0.5
1,3,5-Trimethylbenzene	ug/L	9	<0.5	<0.5	<0.5	3	<0.5	<0.5	<0.5
1,3-Dichlorobenzene	ug/L	9	<0.5	<0.5	<0.5	3	<0.5	<0.5	<0.5
1,3-Dichloropropane	ug/L	9	<0.5	<0.5	<0.5	3	<0.5	<0.5	<0.5
1,3-Dichloropropene (Total)	ug/L	9	<0.5	<0.5	<0.5	3	<0.5	<0.5	<0.5
1,4-Dichlorobenzene	ug/L	9	<0.5	<0.5	<0.5	3	<0.5	<0.5	<0.5
1-Phenylpropane (n-Propylbenzene)	ug/L	9	<0.5	<0.5	<0.5	3	<0.5	<0.5	<0.5
2,2-Dichloropropane	ug/L	9	<0.5	<0.5	<0.5	3	<0.5	<0.5	<0.5
2-Chlorotoluene	ug/L	9	<0.5	<0.5	<0.5	3	<0.5	<0.5	<0.5

Table D-3 Summary of 2019 Recharge Water Quality Volatile Organic Compounds Data

Parameter	Units	Recharge System							
		Coyote				Westside			
		n	Min	Median	Max	n	Min	Median	Max
4-Chlorotoluene	ug/L	9	<0.5	<0.5	<0.5	3	<0.5	<0.5	<0.5
Benzene	ug/L	9	<0.5	<0.5	<0.5	3	<0.5	<0.5	<0.5
Benzo (a) Pyrene	ug/L	9	<0.1	<0.1	<0.1	6	<0.1	<0.1	<0.1
Bromobenzene	ug/L	9	<0.5	<0.5	<0.5	3	<0.5	<0.5	<0.5
Carbon Tetrachloride	ug/L	9	<0.5	<0.5	<0.5	3	<0.5	<0.5	<0.5
Chloroethane	ug/L	9	<0.5	<0.5	<0.5	3	<0.5	<0.5	<0.5
Chloromethane	ug/L	9	<0.5	<0.5	<0.5	3	<0.5	<0.5	<0.5
cis-1,2-Dichloroethene	ug/L	9	<0.5	<0.5	<0.5	3	<0.5	<0.5	<0.5
Dichlorodifluoromethane (Freon 12)	ug/L	9	<0.5	<0.5	<0.5	3	<0.5	<0.5	<0.5
Dichloromethane	ug/L	9	<0.5	<0.5	<0.5	2	<0.5	<0.5	<0.5

Notes:

1. n = number of samples
2. Volatile Organic Compounds were not measure in the Los Gatos Watershed
3. ug/L = micrograms per liter

Table D-4 Summary of 2019 Recharge Water Quality Pesticide Data

Parameter	Units	Recharge System											
		Coyote				Los Gatos				Westside			
		n	Min	Median	Max	n	Min	Median	Max	n	Min	Median	Max
Alachlor	ug/L	9	<0.25	<0.25	<0.25	3	<0.25	<0.25	<0.25	6	<0.25	<0.25	<0.25
Atrazine	ug/L	9	<0.25	<0.25	<0.25	3	<0.25	<0.25	<0.25	6	<0.25	<0.25	<0.25
cis-1,3-Dichloropropene	ug/L	9	<0.5	<0.5	<0.5	0	N/A	N/A	N/A	3	<0.5	<0.5	<0.5
gamma-BHC (lindane)	ug/L	9	<0.2	<0.2	<0.2	3	<0.2	<0.2	<0.2	6	<0.2	<0.2	<0.2
Hexachlorobenzene	ug/L	9	<0.25	<0.25	<0.25	3	<0.25	<0.25	<0.25	6	<0.25	<0.25	<0.25
Hexachlorocyclopentadiene	ug/L	9	<0.5	<0.5	<0.5	3	<0.5	<0.5	<0.5	6	<0.5	<0.5	<0.5
Methoxychlor	ug/L	9	<0.5	<0.5	<0.5	3	<0.5	<0.5	<0.5	6	<0.5	<0.5	<0.5
Molinate	ug/L	9	<0.5	<0.5	<0.5	3	<0.5	<0.5	<0.5	6	<0.5	<0.5	<0.5
Simazine	ug/L	9	<0.25	<0.25	<0.25	3	<0.25	<0.25	<0.25	6	<0.25	<0.25	<0.25
Thiobencarb	ug/L	9	<0.25	<0.25	<0.25	3	<0.25	<0.25	<0.25	6	<0.25	<0.25	<0.25
trans-1,3,Dichloropropene	ug/L	9	<0.5	<0.5	<0.5	0	N/A	N/A	N/A	3	<0.5	<0.5	<0.5

Notes:

1. n = number of samples
2. N/A = not measured
3. ug/L = micrograms per liter

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APPENDIX E

2019 Water Quality Evaluation at Recycled Water Irrigation Sites

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Table E-1 Summary of 2019 Santa Clara Subbasin Recycled Water Data

Parameter	Units	Santa Clara Subbasin, Santa Clara Plain				Maximum Contaminant Level	
		n	Min	Median	Max	MCL	SMCL
Major and Minor Ions							
Bicarbonate Alkalinity (as CaCO3)	mg/L	10	160	330	820	--	--
Calcium	mg/L	10	42	90	370	--	--
Chloride	mg/L	10	23	124	390	--	250
Magnesium	mg/L	10	15	65	160	--	--
Potassium	mg/L	10	<1.0	1.6	5.9	--	--
Sodium	mg/L	10	35	57	280	--	--
Sulfate	mg/L	10	38	72	920	--	250
Total Dissolved Solids (TDS)	mg/L	10	280	645	2,100	--	500
Nutrients							
Nitrate (as N)	mg/L	10	<0.05	4.57	8.80	10	--
Trace Elements							
Boron	mg/L	10	<0.2	<0.2	0.85	--	--

Notes:

1. Table includes data for wells near areas irrigated with water from South Bay Water Recycling (SBWR)
2. n = number of results
3. MCL = Maximum Contaminant Level as specified in Title 22 of the California Code of Regulations
4. SMCL = Secondary Maximum Contaminant Level or aesthetic-based standard per DDW or US EPA
5. mg/L = milligrams per liter, ug/L = micrograms per liter; ng/L = nanograms per liter

Table E-2 Summary of 2019 Llagas Subbasin Recycled Water Irrigation Inorganic Data

Parameter	Units	Llagas Subbasin				Maximum Contaminant Level	
		n	Min	Median	Max	MCL	SMCL
Major and Minor Ions							
Bromate	ug/L	20	<0.25	<0.25	0.29	10	--
Bromide	mg/L	20	0.05	0.05	0.66	--	--
Calcium	mg/L	20	7.3	47	97	--	--
Calcium (as CaCO3)	mg/L	20	18.3	117	242	--	--
Chloride	mg/L	20	<5	27	212	--	250
Cyanide	mg/L	20	<0.025	<0.025	<0.025	150	-
Fluoride (natural source)	mg/L	20	<0.1	<0.1	0.5	2	--
Magnesium	mg/L	20	2.9	25	66	--	--
Perchlorate	ug/L	20	<4	<4	<4	6	--
Potassium	mg/L	20	<0.5	1.1	2.4	--	--
Silica	mg/L	20	8.5	25	35	--	--
Sodium	mg/L	20	3.5	25	158	--	--
Sulfate	mg/L	20	2.8	41	118	--	250
Total Dissolved Solids (TDS)	mg/L	20	77	313	820	--	500
Nutrients							
Nitrate (as N)	mg/L	20	<0.05	1.9	28	10	--
Orthophosphate (as P)	mg/L	18	<0.05	<0.05	0.13	--	--
Trace Elements							
Aluminum	ug/L	20	<20	37	220	1,000	200
Antimony	ug/L	20	<1	<1	<1	6	--
Arsenic	ug/L	20	<2	<2	2	10	--
Barium	ug/L	20	22	83	490	1,000	--
Beryllium	ug/L	20	<1	<1	<1	4	--
Boron	ug/L	20	<50	100	353	--	--
Cadmium	ug/L	20	<1	<1	<1	5	--
Chromium	ug/L	20	<1	<1	4.2	50	--
Cobalt	ug/L	20	<1	<1	3.9	--	--
Copper	ug/L	20	<1	2.1	6.3	1,300	1,000
Iron	ug/L	20	<20	<20	250	--	300
Lead	ug/L	20	<1	<1	3.9	--	--
Lithium	ug/L	20	<5	5.7	11	--	--
Manganese	ug/L	20	<1	1.0	1,330	--	50
Mercury	ug/L	20	<1	<1	<1	2	--
Molybdenum	ug/L	20	<1	<1	4.5	--	--

Table E-2 Summary of 2019 Llagas Subbasin Recycled Water Irrigation Inorganic Data

Parameter	Units	Llagas Subbasin				Maximum Contaminant Level	
		n	Min	Median	Max	MCL	SMCL
Nickel	ug/L	20	<1	1.9	21	100	--
Selenium	ug/L	20	<5	<5	6	50	--
Silver	ug/L	20	<1	<1	<1	--	100
Thallium	ug/L	20	<1	<1	<1	2	--
Vanadium	ug/L	20	<1	1.2	4.6	--	--
Zinc	ug/L	20	<10	<10	<10	--	5,000

Notes:

1. Table includes data for wells near areas irrigated with water from South County Regional Wastewater Authority (SCRWA)
2. n = number of results
3. MCL = Maximum Contaminant Level as specified in Title 22 of the California Code of Regulations
4. SMCL = Secondary Maximum Contaminant Level or aesthetic-based standard per DDW or US EPA
5. mg/L = milligrams per liter, ug/L = micrograms per liter; ng/L = nanograms per liter

Table E-3 Summary of 2019 Llagas Subbasin Recycled Water Irrigation Organic Data

Parameter	Units	Llagas Subbasin				Maximum Contaminant Level	
		n	Min	Median	Max	MCL	SMCL
Bromochloroacetic Acid (BCAA)	ug/L	20	<1	<1	<1	1,000	200
Bromochloromethane	ug/L	20	<0.5	<0.5	<0.5	6	--
Bromodichloroacetic Acid (BDCAA)	ug/L	20	<1	<1	<1	10	--
Bromodichloromethane (THM)	ug/L	20	<0.5	<0.5	<0.5	--	--
Bromoform (THM)	ug/L	20	<0.5	<0.5	<0.5	--	--
Bromomethane	ug/L	20	<0.5	<0.5	<0.5	--	--
Chlorodibromoacetic Acid (CDBAA)	ug/L	20	<2	<2	<2	--	--
Chloroform (THM)	ug/L	20	<0.5	<0.5	<0.5	--	--
Dibromoacetic Acid (DBAA)	ug/L	20	<1	<1	<1	--	--
Dibromochloromethane (THM)	ug/L	20	<0.5	<0.5	<0.5	--	--
Dibromomethane	ug/L	20	<0.5	<0.5	<0.5	--	--
Dichloroacetic Acid (DCAA)	ug/L	20	<1	<1	<1	--	--
Haloacetic Acids (HAA5)	ug/L	20	1	1	1	--	--
Monobromoacetic Acid (MBAA)	ug/L	20	<1	<1	<1	--	--
Monochloroacetic Acid (MCAA)	ug/L	20	<2	<2	<2	--	--
n-Nitrosodiethylamine (NDEA)	ng/L	20	<2	<2	<2	--	--
n-Nitrosodimethylamine (NDMA)	ng/L	20	<2	<2	5	--	--
n-Nitrosodi-n-Butylamine (NDBA)	ng/L	20	<2	<2	<2	--	--
n-Nitrosodi-n-Propylamine (NDPA)	ng/L	20	<2	<2	<2	--	--
n-Nitrosomethylethylamine (NMEA)	ng/L	20	<2	<2	<2	--	--
n-Nitrosopyrrolidine (NPYR)	ng/L	20	<2	<2	<2	--	--
Perfluoro Butanoic Acid (PFBA)	ng/L	20	<10	<10	50	--	--
Perfluorooctyl Sulfonate (PFOS)	ng/L	20	<5	<5	96	--	--
Perfluorooctanoic Acid (PFOA)	ng/L	20	<5	<5	59	--	--
Tribromoacetic Acid (TBAA)	ug/L	20	<4	<4	<4	--	--
Trichloroacetic Acid (TCAA)	ug/L	20	<1	<1	<1	--	--

Notes:

1. Table includes data for wells near areas irrigated with water from South County Regional Wastewater Authority (SCRWA)
2. n = number of results
3. MCL = Maximum Contaminant Level as specified in Title 22 of the California Code of Regulations
4. SMCL = Secondary Maximum Contaminant Level or aesthetic-based standard per DDW or US EPA
5. mg/L = milligrams per liter, ug/L = micrograms per liter; ng/L = nanograms per liter

APPENDIX F

Water Quality 2019 Report for the Santa Clara and Llagas Subbasins

(Submitted to the California Department of Water Resources in April 2020)

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March 2020

Water Year 2019 Report for the Santa Clara and Llagas Subbasins

Valley Water

Santa Clara Valley Water District

Water Year 2019 Report for the Santa Clara and Llagas Subbasins

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March 2020

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Executive Summary

EXECUTIVE SUMMARY

The Santa Clara Valley Water District (Valley Water) is the Groundwater Sustainability Agency for the Santa Clara and Llagas subbasins (Basins 2-9.02 and 3-3.01, respectively) in Santa Clara County, which are sustainably managed due to the comprehensive activities described in Valley Water's 2016 Groundwater Management Plan (Plan).[1] This Water Year 2019 Report for the Santa Clara and Llagas Subbasins provides information on groundwater conditions and management as required by the Sustainable Groundwater Management Act (SGMA).[2]

Having previously fully recovered to pre-drought conditions, groundwater elevation and storage remained in healthy condition through Water Year (WY) 2019.[3] Total groundwater pumping was 109,600 acre-feet (AF)[4], providing 37% of the water used by county residents and businesses. WY 2019 was a wet year with adequate surface water supplies were available to support a full managed recharge program with 81,400 AF of local and imported surface water used for groundwater replenishment. Treated water delivered by Valley Water (103,000 AF) and recycled water use (17,100 AF) also provided in-lieu recharge, and countywide water conservation programs reduced water demands by more than 70,000 AF. This comprehensive recharge continues to support a balanced long-term water budget. Inflows exceeded outflows in the Santa Clara and Llagas subbasins, resulting in a net increase in storage of 11,400 and 6,600 AF, respectively.

Valley Water continues to implement the comprehensive activities described in the Plan, and to address the Plan recommendations (as further described in Chapter 4):

- Maintain existing conjunctive water management programs and evaluate opportunities for enhancement or increased efficiency.
- Continue to aggressively protect groundwater quality through Valley Water programs and collaboration with land use agencies, regulatory agencies, and basin stakeholders.
- Continue to incorporate groundwater sustainability planning in Valley Water planning efforts.
- Maintain adequate monitoring programs and modeling tools.
- Continue and enhance groundwater management partnerships with water retailers and land use agencies.
- Evaluate the potential new authorities provided by SGMA.

Valley Water will continue to sustainably manage the Santa Clara and Llagas subbasins as a central part of our mission to provide Silicon Valley safe, clean water for a healthy life, environment, and economy. Implementation of the Plan helps ensure continued sustainability in accordance with SGMA, the Santa Clara Valley Water District Act, and Valley Water Board policy to "aggressively protect groundwater from the threat of contamination and maintain and develop groundwater to optimize reliability and to minimize land subsidence and salt water intrusion."

---

[1] This Plan was submitted to the Department of Water Resources as an Alternative to a Groundwater Sustainability Plan. Per state requirements, an annual report must be submitted by April 1 of each year following Valley Water adoption of the Plan.
[2] A comprehensive calendar-year based Annual Groundwater Report with detailed information on groundwater levels, storage, land subsidence and groundwater quality conditions is available at: https://www.valleywater.org/groundwater.
[3] October 1, 2018 through September 30, 2019
[4] All values presented in this report are based on best available data (measured and/or estimated) and may be refined as additional data becomes available.

CHAPTER 1 – INTRODUCTION

For 90 years, Valley Water has managed groundwater in Santa Clara County under the Santa Clara Valley Water District Act.[5] In December 2016, Valley Water submitted its Board-adopted 2016 Groundwater Management Plan (Plan)[6] to the Department of Water Resources (DWR) as an Alternative to a Groundwater Sustainability Plan under SGMA. Valley Water's comprehensive groundwater management programs and investments described in the Plan have resulted in sustainable groundwater conditions for many decades and will ensure groundwater resources are sustainable into the future.

Under the California Code of Regulations Title 23, Division 2, Chapter 1.5, Subchapter 2, Article 7, §356.2, each agency shall submit an annual report to DWR by April 1 of each year following adoption of the Plan. This report for Water Year (WY) 2019 is the third annual report submitted to DWR. It covers the Santa Clara Subbasin (DWR Basin 2-9.02) and the Llagas Subbasin (Basin 3-3.01), which are managed in their entirety by Valley Water. Figure 1 shows the location of the two groundwater subbasins.

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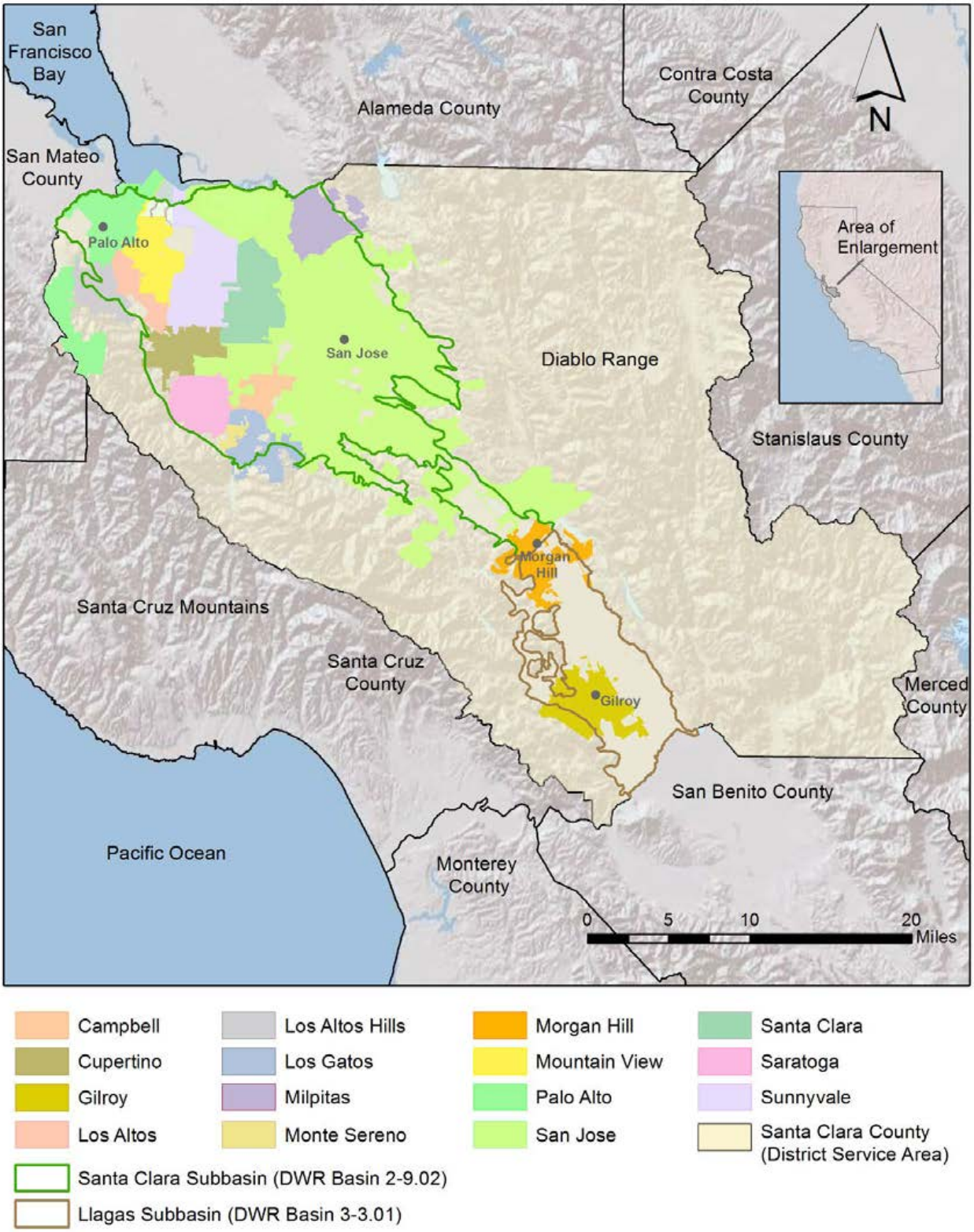
[5] Santa Clara Valley Water District Act, Water Code Appendix, Chapter 60.
[6] https://www.valleywater.org/your-water/where-your-water-comes-from/groundwater

Figure 1. Santa Clara and Llagas Subbasin Location Map



CHAPTER 2 – GROUNDWATER ELEVATION DATA

Valley Water tracks groundwater elevations, groundwater quality, and land subsidence through a countywide groundwater monitoring program. In WY 2019, Valley Water collected monthly groundwater elevation readings at 157 wells in the Santa Clara Subbasin and 61 wells in the Llagas Subbasin. Furthermore, local water retailers shared groundwater elevation data at 114 wells. While this report provides a summary of groundwater elevations based on 11 regional wells, all available countywide groundwater elevation data are accessible through the Valley Water website.[7] Valley Water also regularly uploads groundwater elevation data for Valley Water-owned wells to the California Statewide Groundwater Elevation Monitoring (CASGEM) program database.

Groundwater elevation contour maps for the Santa Clara and Llagas subbasins and related measurement locations are presented in Figures 2 and 3 for Spring 2019 and Fall 2019, respectively.[8] These contours represent the principal aquifer within each subbasin because those aquifers support the vast majority of pumping. Seasonal high groundwater conditions typically occur in March or April, with seasonal lows in September or October. The spring and fall maps (Figures 2 and 3) were created using the water level readings measured closest to March 31, 2019 and September 30, 2019, respectively.

This report also presents groundwater elevation data from 11 regional wells in the Santa Clara and Llagas subbasins (Figure 4); these wells are spatially distributed within the two subbasins and various cities in the county. Hydrographs for these wells show the static water level trend over the period of record, which varies by well (Figure 5).

Due to good water supply conditions, robust managed recharge, and continued water use reduction by the community, groundwater elevations generally returned to pre-drought conditions in WY 2017. In fact, water levels in many wells approached or exceeded historical high levels. Groundwater levels remained sustainable in WY 2018 and 2019 (Figure 5) due to continued managed recharge and water use reduction. Groundwater elevations in WY 2019 were far above the historical minima and levels during the last major droughts of 1987-1992 and 2012-2016, with strong artesian pressures observed in the northern Santa Clara Subbasin. Groundwater elevations were also well above Valley Water thresholds established to minimize the risk of land subsidence in the Santa Clara Subbasin.[9]

[7] https://gis.valleywater.org/GroundwaterElevations
[8] Groundwater elevations in this report use the North American Vertical Datum of 1988 (NAVD 88).
[9] As described in the Plan, land subsidence was a significant issue historically in the central and northern Santa Clara Subbasin. See Valley Water's Annual Groundwater Report for Calendar Year 2018 for a detailed discussion of recent subsidence monitoring: https://www.valleywater.org/groundwater. Note, the CY 2019 report will be available in summer 2020.

Figure 2. Spring 2019 Groundwater Elevation Contours

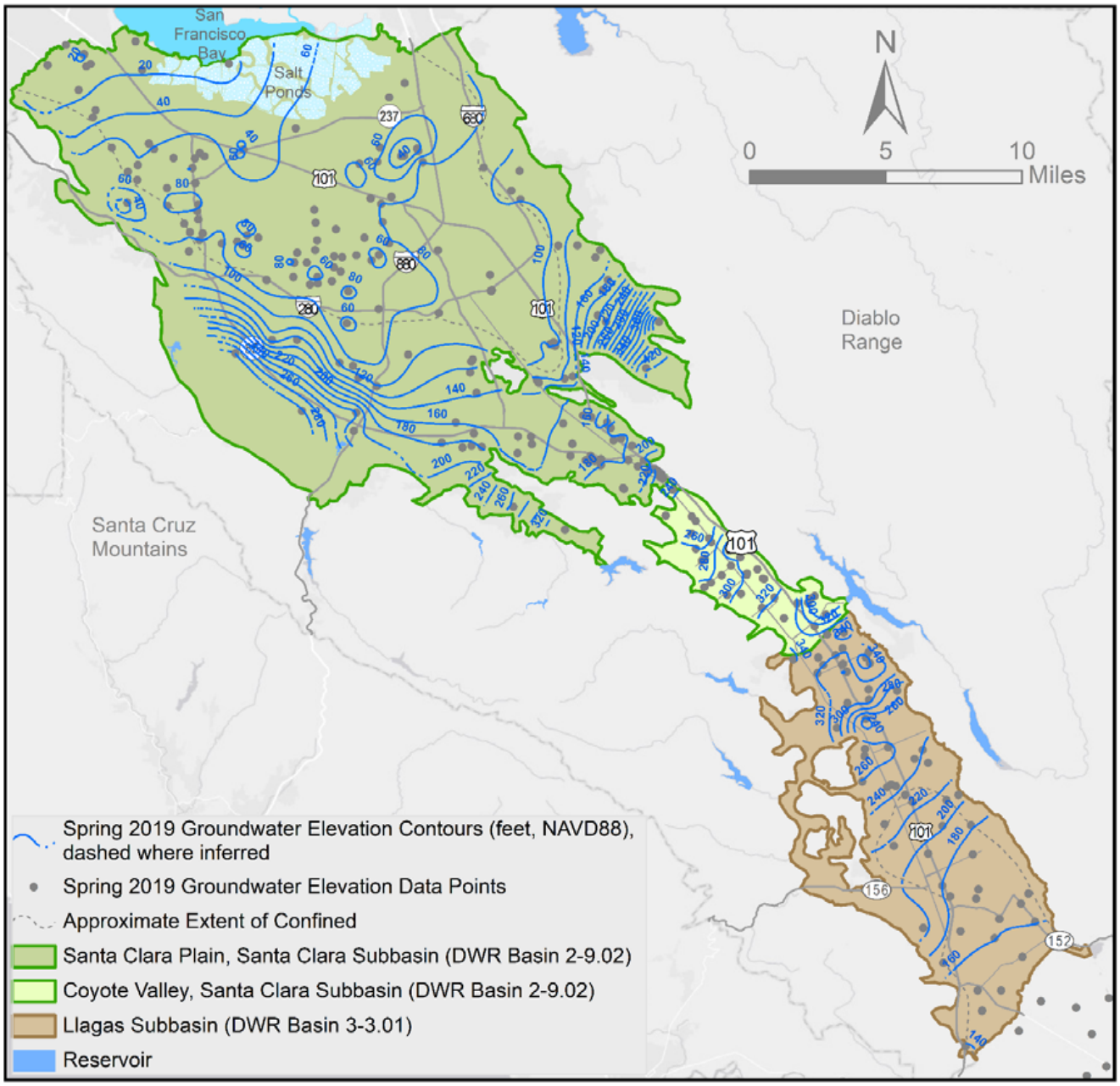


Figure 3. Fall 2019 Groundwater Elevation Contours

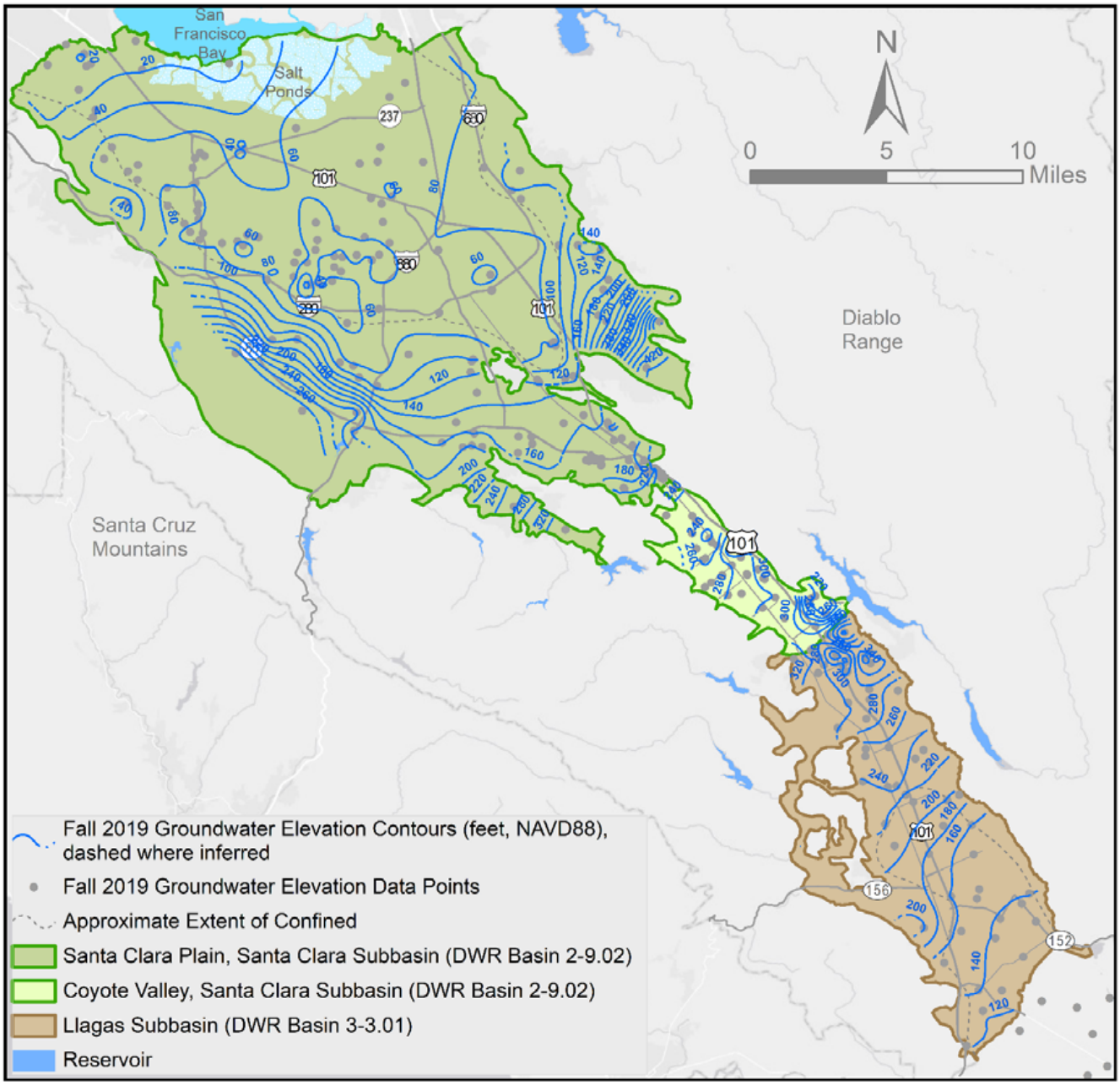


Figure 4. Regional Groundwater Elevation Monitoring Wells

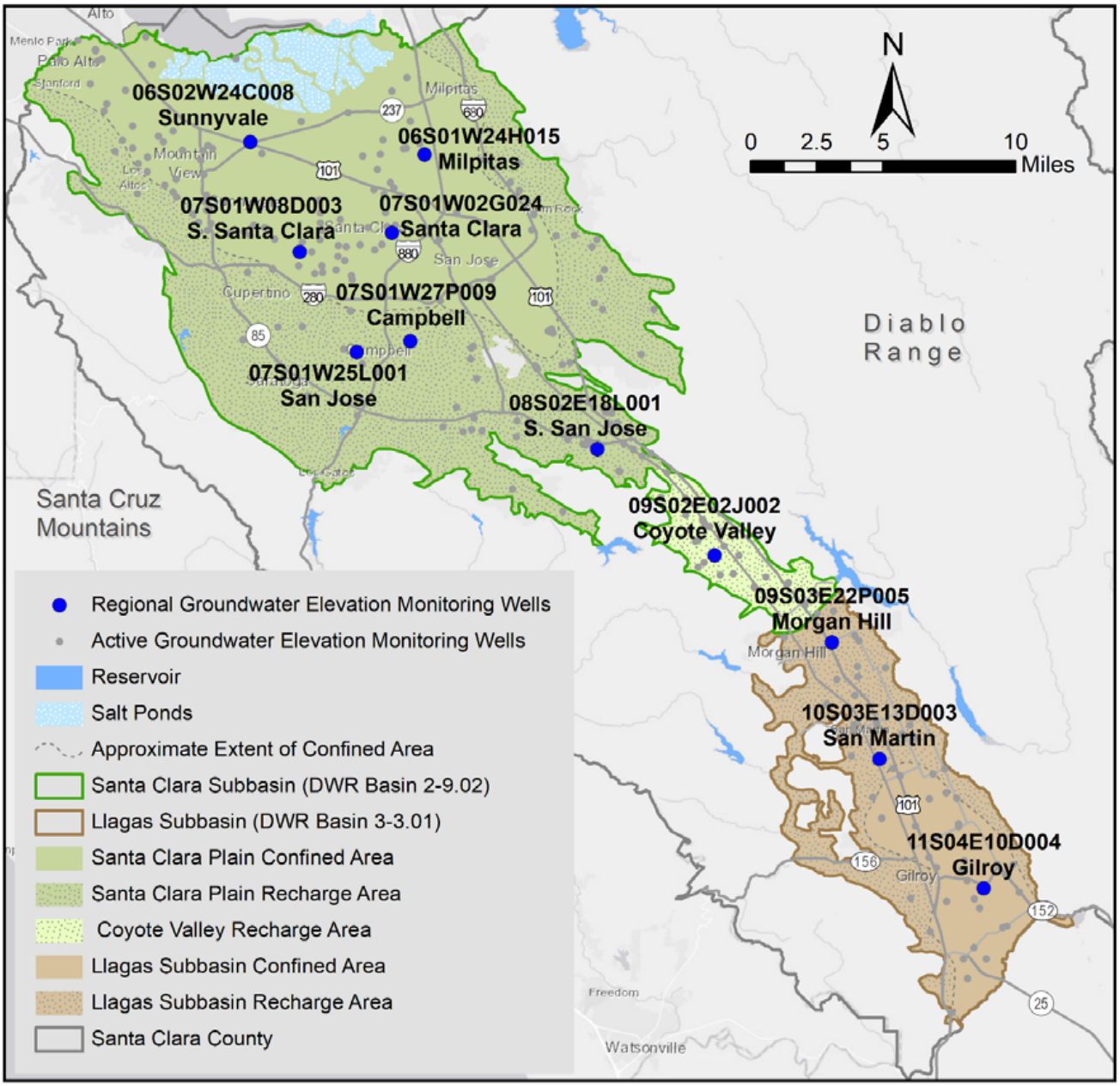
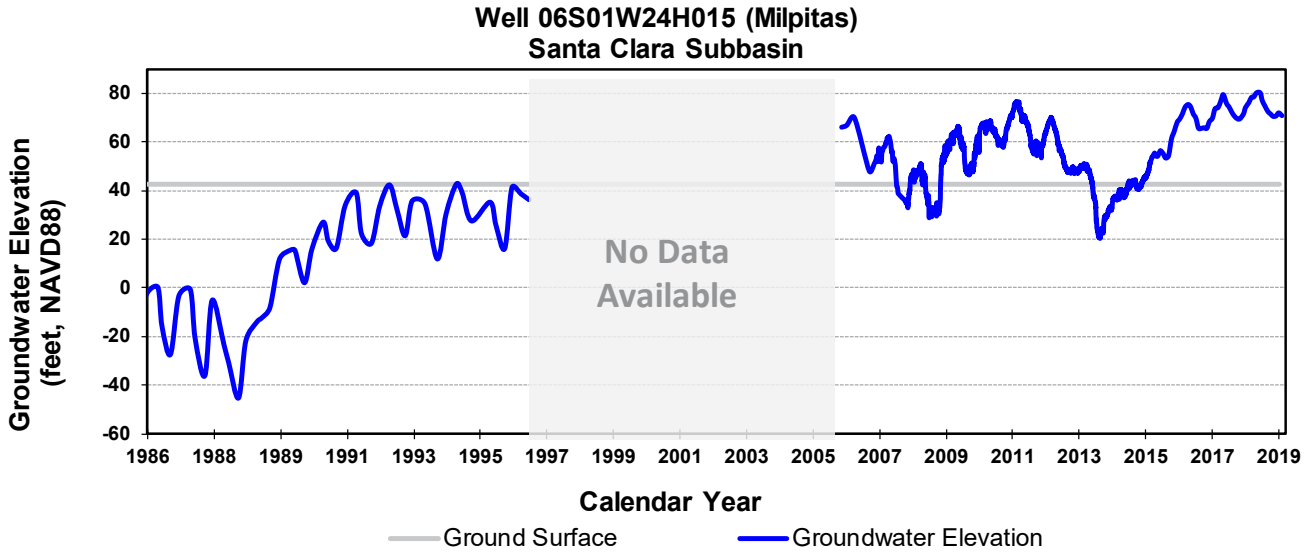
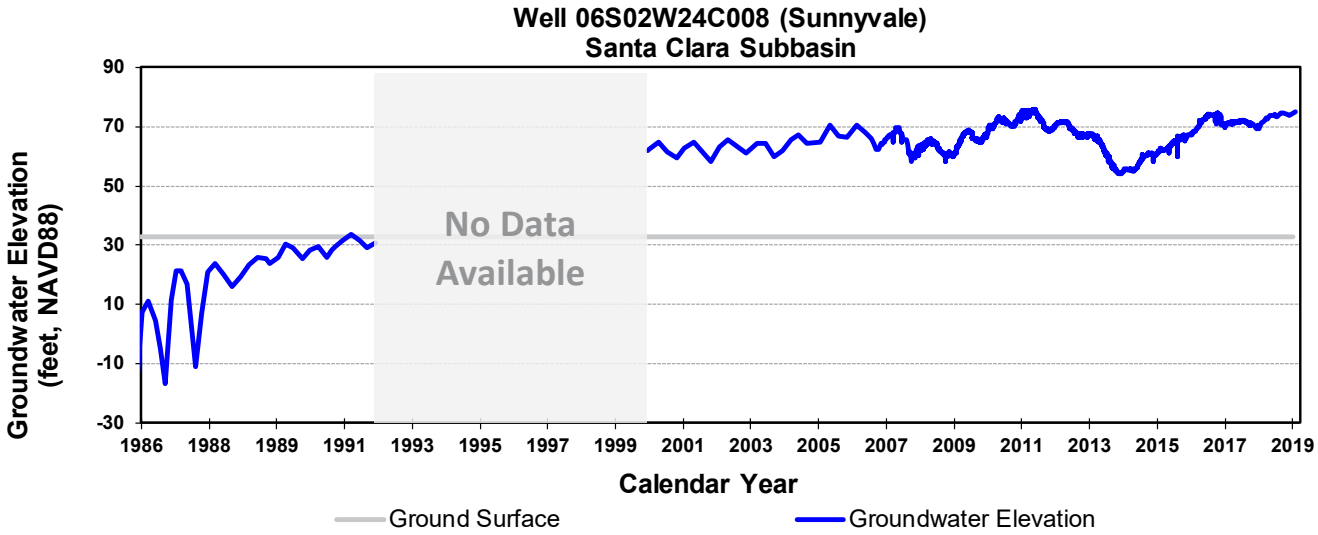


Figure 5. Hydrographs at Regional Groundwater Elevation Monitoring Wells

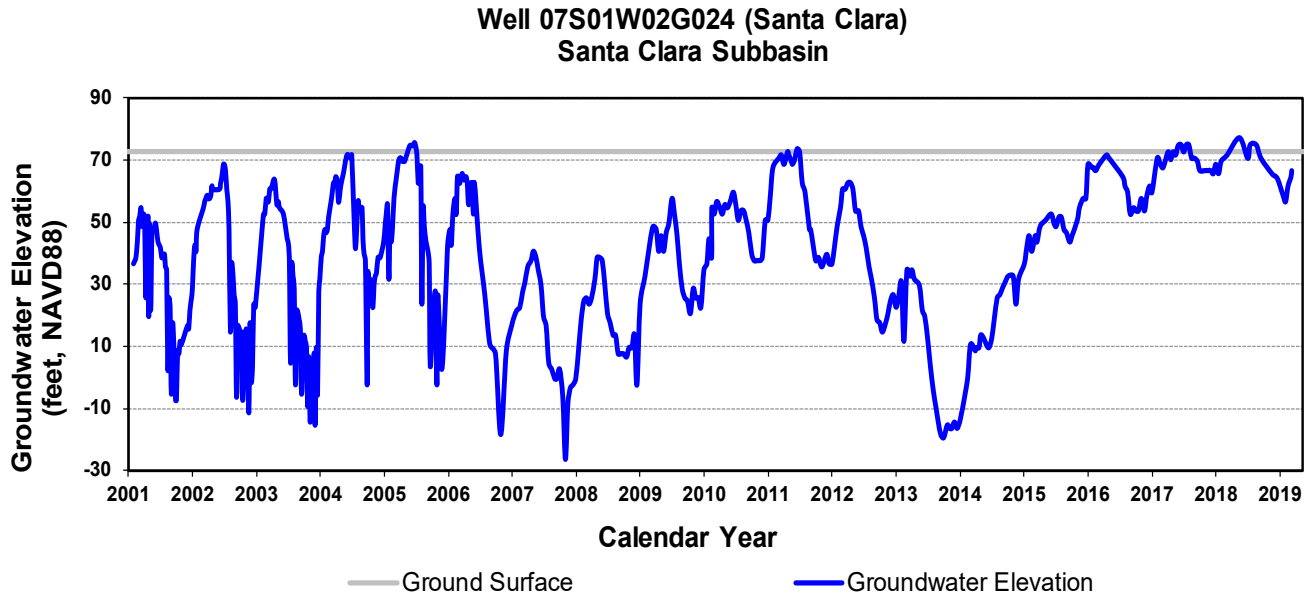


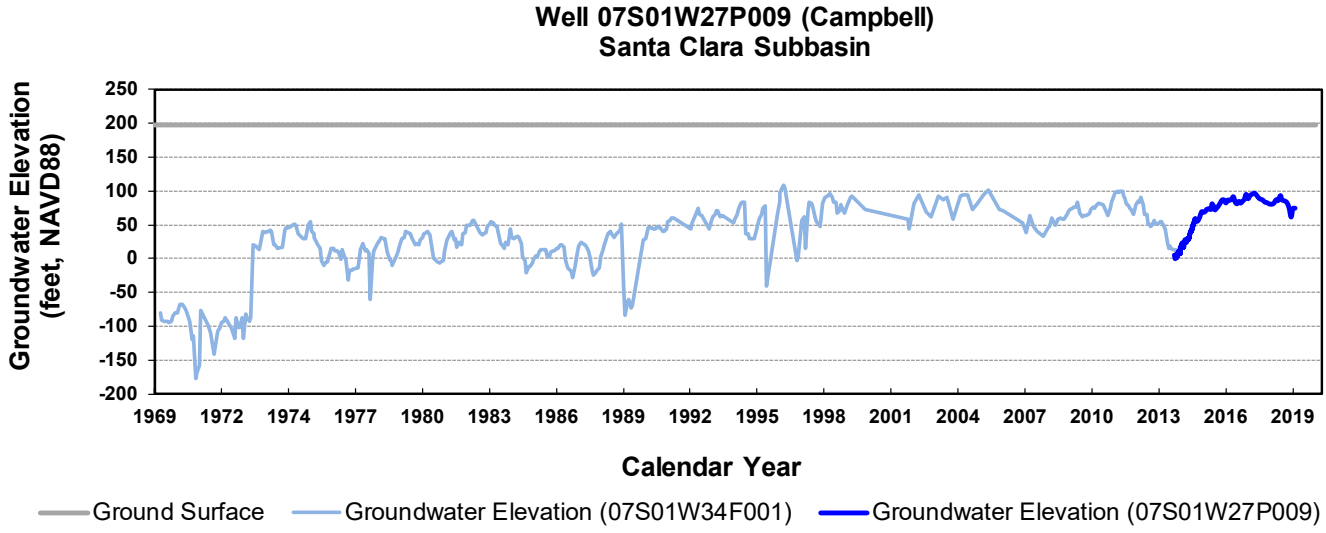
During period with no data available, well was observed to be artesian but there was no pressure gauge installed.



During period with no data available, well was observed to be artesian but there was no pressure gauge installed.

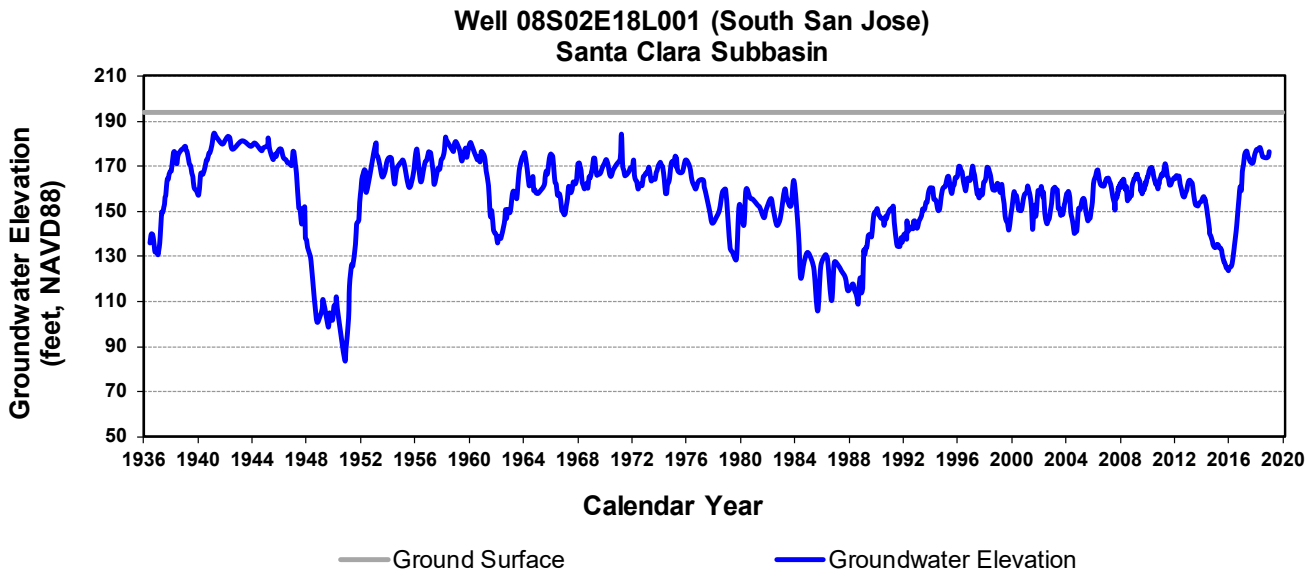
Figure 5. Hydrographs at Regional Groundwater Elevation Monitoring Wells (continued)





The Campbell well was replaced in August 2015 with a nearby well with similar water level history.

Figure 5. Hydrographs at Regional Groundwater Elevation Monitoring Wells (continued)



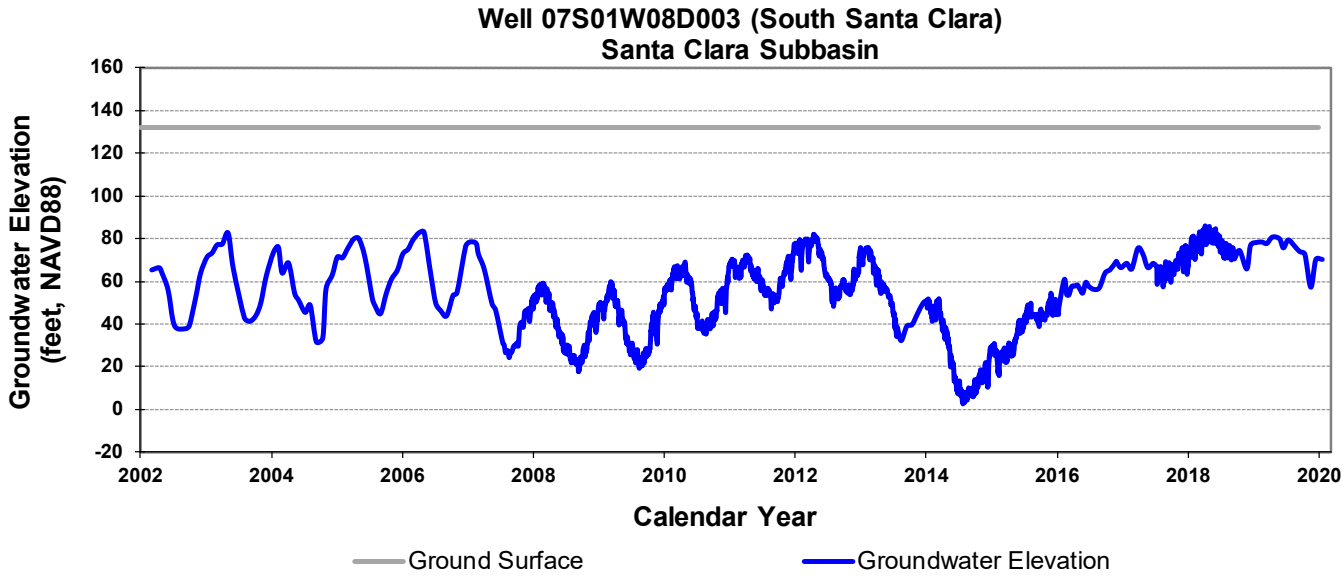
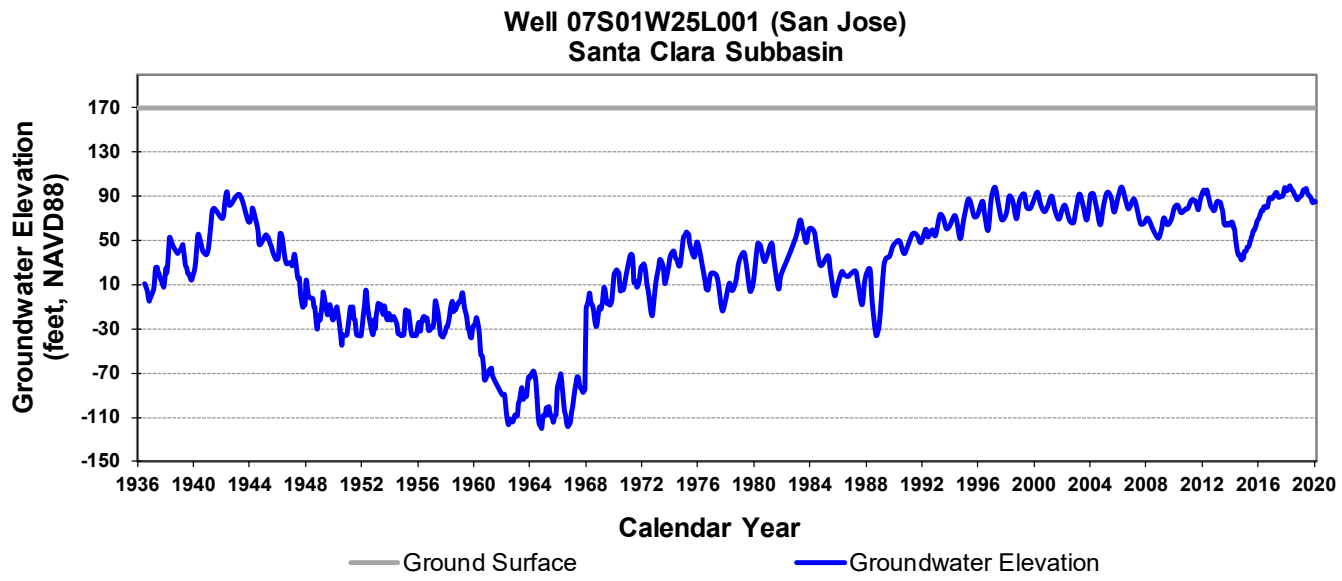


Figure 5. Hydrographs at Regional Groundwater Elevation Monitoring Wells (continued)



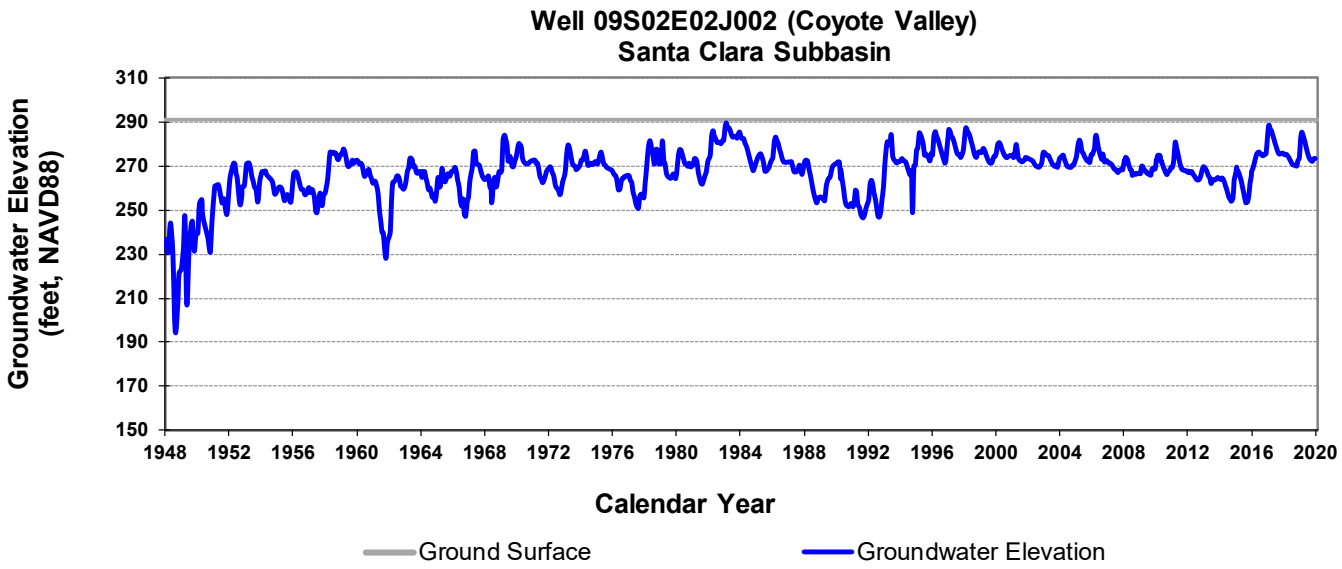
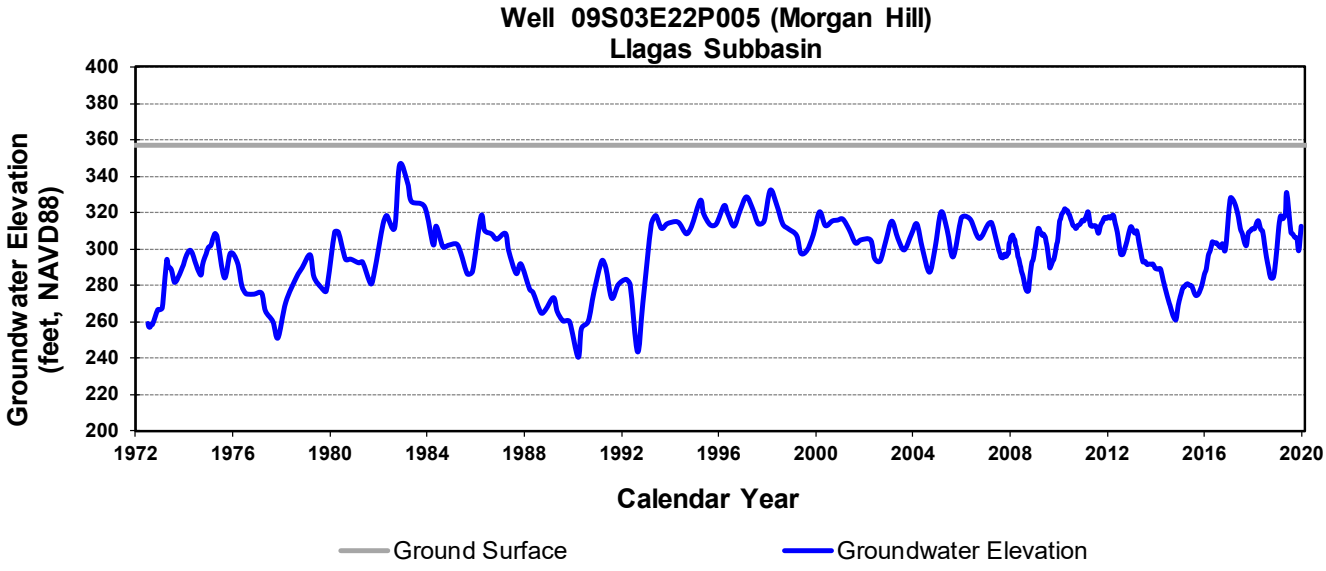


Figure 5. Hydrographs at Regional Groundwater Elevation Monitoring Wells (continued)



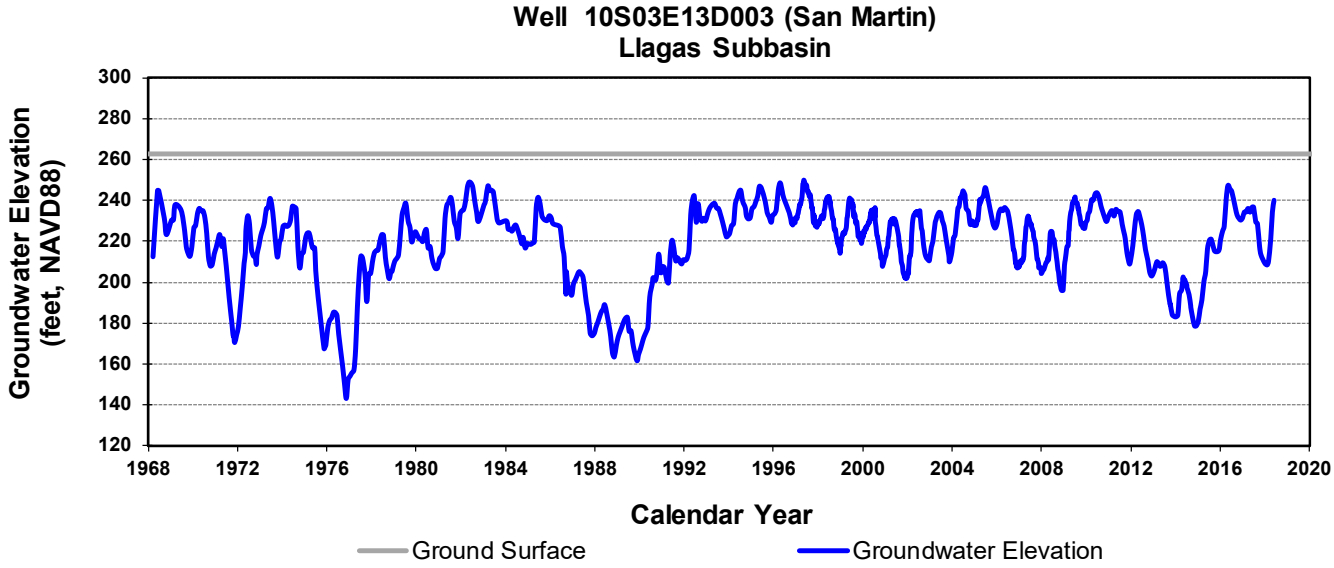
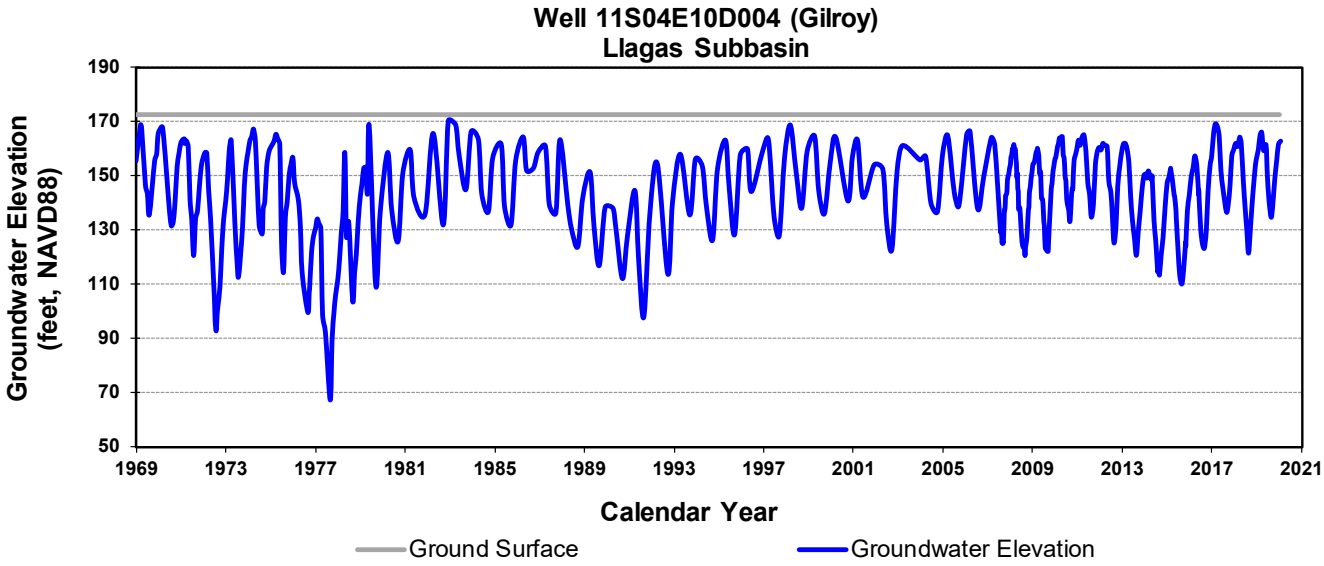


Figure 5. Hydrographs at Regional Groundwater Elevation Monitoring Wells (continued)



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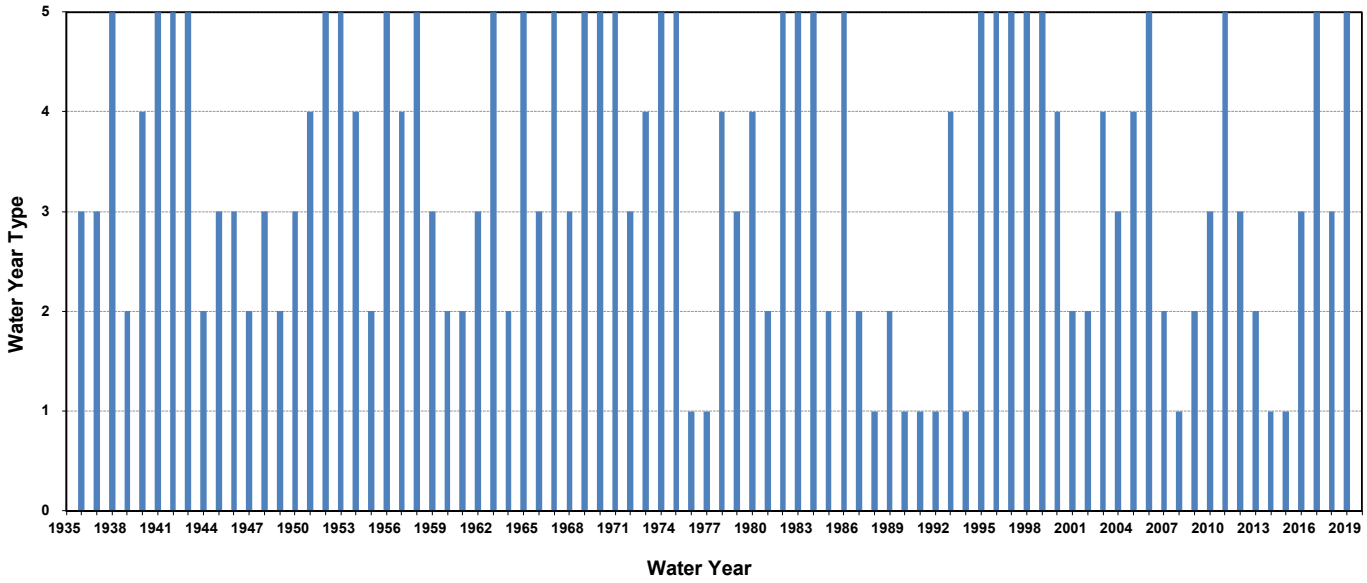
WY 2019 was a wet year based on the DWR Sacramento River Index (SRI) (Figure 6). Valley Water uses historical SRI water year types to model hydrologic conditions in Santa Clara County as it reflects conditions in the Sierra and the Sacramento-San Joaquin Delta that influence Valley Water's imported water deliveries. Rainfall stations within Santa Clara County confirm that the rainfall season from July 1, 2018 to June 30, 2019 was above the historical average. For instance, rainfall in downtown San Jose (Station 131) was approximately 15.7 inches or 131% of average.

Figure 6. Water Year Types from WY 1936 to 2019 – Sacramento River Index (SRI)



Water Year Types per DWR SRI: 1 (Critical); 2 (Dry); 3 (Below Normal); 4 (Above Normal); 5 (Wet)

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CHAPTER 3 – WATER SUPPLY AND USE

Valley Water manages a diverse water supply portfolio, with sources including groundwater, local surface water, imported water, and recycled water. About half of the county's water supply comes from local sources with the other half from imported sources. Imported water includes Valley Water's State Water Project (SWP) and Central Valley Project (CVP) contract supplies and supplies delivered by the San Francisco Public Utilities Commission (SFPUC) to northern Santa Clara County. Local sources include natural groundwater recharge and surface water supplies. A smaller but growing portion of the county's local water supply is recycled water.

Valley Water distributes local and imported surface water supplies to managed recharge facilities, three drinking water treatment plants, local creeks for environmental needs, or directly to water users. The conjunctive management of surface water and groundwater maximizes water supply reliability, allowing Valley Water to store surface water in local groundwater basins to help balance pumping and provide reserves for use during dry years or water shortages.

3.1 Groundwater Extraction

Total groundwater pumping in WY 2019 was 109,600 AF, providing 37% of the water used by county residents and businesses. Figure 7 shows the location and volume of groundwater pumping, and Table 1 summarizes pumping by subbasin, water use category, and measurement method and accuracy.

About 67,200 AF of groundwater was pumped in the Santa Clara Subbasin, with almost 95% of that supporting municipal and industrial (M&I) uses (Table 1). Agricultural and domestic use totaling 4,100 AF was mostly in the more rural Coyote Valley in the southern Santa Clara Subbasin. Total pumping in the Llagas Subbasin was 42,400 AF. In this subbasin, agricultural use was more significant (23,500 AF), accounting for 55% of the total pumping. M&I groundwater use was 17,000 AF or 40% of subbasin pumping. While the quantity of groundwater used for domestic purposes was relatively small in the Llagas Subbasin (1,800 AF or 4%), over 2,600 individual domestic wells reported groundwater use in WY 2019.

Groundwater pumped from the subbasins is recorded in accordance with the Santa Clara Valley Water District Act. This act requires well owners and operators to register all wells within the county and to file monthly, semi-annual, or annual production statements for water-producing wells within Valley Water's groundwater benefit zones, with reporting frequency dependent on the amount of water produced. By Valley Water Board Resolution, meters are only installed at those sites determined to be economically feasible per approved criteria or as required to facilitate the complete and accurate collection of groundwater production revenue. In the northern Zone W-2, which essentially overlaps the northern Santa Clara Subbasin (Santa Clara Plain groundwater management area), meters are required for facilities producing more than 4 AF of agricultural water or more than 1 AF of non-agricultural water annually. Within Zone W-5 (essentially coincident with the Coyote Valley groundwater management area of the Santa Clara Subbasin, and the Llagas Subbasin), meters are required for facilities producing more than 20 AF of agricultural water or more than 2 AF of non-agricultural water.

Metered wells extracted the vast majority (97,900 AF or 89%) of the groundwater pumped in WY 2019. Where meters were not used, crop factors were used to determine agricultural water use, whereas domestic use was estimated from a table of average uses.

Figure 7. WY 2019 Groundwater Pumping in the Santa Clara and Llagas Subbasins

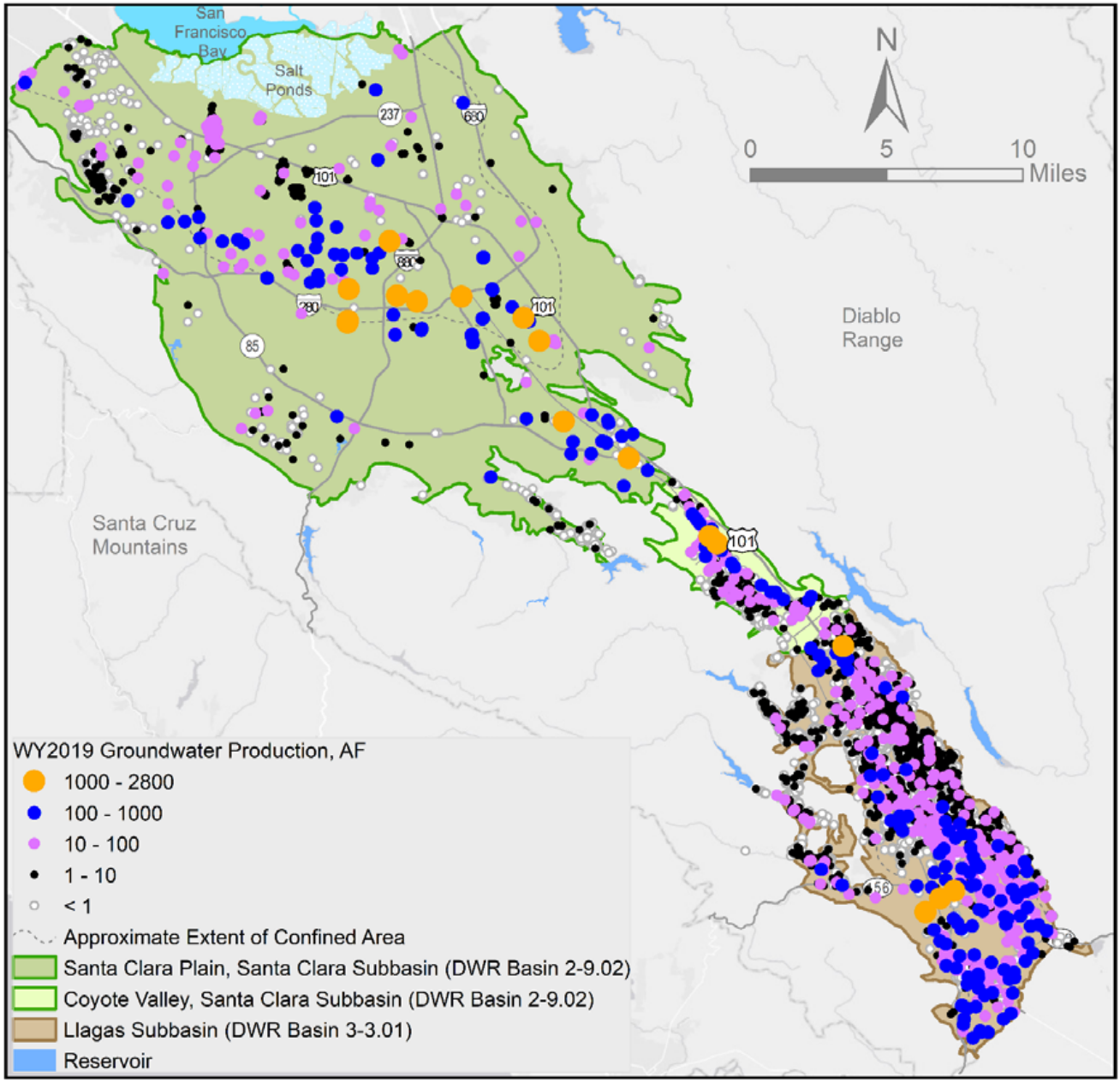

Table 1. WY 2019 Groundwater Pumping (AF) by Water Use

Water Use Sector	Measurement Method	Santa Clara Subbasin	Llagas Subbasin	Total Pumping	Accuracy
M&I	Metered	61,600	16,400	78,000	Within 2%
	Estimated	1,500	600	2,100	N/A
Domestic	Metered	100	200	300	Within 2%
	Estimated	400	1,700	2,100	N/A
Agricultural	Metered	2,700	16,900	19,600	Within 2%
	Estimated	900	6,600	7,500	N/A
Total		**67,200**	**42,400**	**109,600**	

Notes:

- As shown above, the majority of groundwater pumping is metered. Smaller pumpers are required to report production semi-annually or annually on a fiscal year (July 1 – June 30) basis. Non-metered pumpers report groundwater pumping based on crop factors (agricultural use) or table of average uses (domestic use). In this table, estimated pumping shown for the water year is based on fiscal year reporting and typical pumping patterns.
- All values are rounded to the nearest hundred.

3.2 Surface Water Supply Used

In WY 2019, Valley Water actively recharged about 81,400 AF of imported and local surface water in the Santa Clara and Llagas subbasins. Valley Water also provided about 105,000 AF of in-lieu recharge in the form of treated surface water deliveries to retailers (cities and water companies) and raw surface water deliveries to customers (Table 2). This is in addition to SFPUC deliveries to eight water retailers overlying the Santa Clara Subbasin and recycled water deliveries by Valley Water and four recycled water producers in the county, which totaled 60,400 AF countywide (Table 2). Valley Water's long-term water conservation programs also saved more than 70,000 AF, which further reduced the demand on groundwater.

Valley Water Managed Recharge

Valley Water replenishes the groundwater subbasins with imported water and watershed runoff captured in 10 local reservoirs. Valley Water's recharge facilities include more than 300 acres of recharge ponds and over 90 miles of creeks. Imported sources include the SWP and the federal CVP. The volumes of imported or local water used for managed recharge each year depend on many factors including hydrology, imported water allocations, treatment plants demand, and environmental needs. In general, a greater percentage of local water is used for recharge in wet years due to increased capture of storm runoff in local reservoirs. In WY 2019, Valley Water recharged about 58,400 AF of local and imported water in the Santa Clara Subbasin and about 23,000 AF in the Llagas Subbasin.

In-Lieu Use of Surface Water Supplies

Valley Water's treated and raw surface water deliveries, SFPUC supplies to local retailers, and recycled water programs play a critical role in maintaining groundwater elevations and storage by reducing demands on groundwater. Table 2 summarizes the supplies from these categories in areas that were historically primarily or solely served by groundwater.

3.3 Total Water Use

Total water use in Santa Clara County in WY 2019 is summarized in Table 2, which includes water use categories, measurement methods and accuracy, water sources, and use sectors. While the county boundary extends beyond the subbasins, the vast majority of the population and associated water use coincides with the subbasins.

Table 2. Santa Clara County Total Water Use in AF for WY 2019

Water Use[1]	Santa Clara Subbasin	Llagas Subbasin	County-wide	Measurement Method	Accuracy	Source	Sector
Groundwater Pumped	67,200	42,400	109,600	Metered (89%) and estimated[2]	Within 2% (metered)	Natural recharge, managed recharge of local runoff and imported (SWP/CVP) water	M&I, domestic and agricultural[3]
Valley Water Treated Water Deliveries	103,000	0	103,000	Metered	Within 2%	Local runoff and imported (SWP/CVP) water	M&I
Valley Water Raw Surface Water Deliveries	700	1,300	2,000	Metered (95%) and estimated[2]	Within 2% (metered)	Local runoff and imported (SWP/CVP) water	M&I, domestic and agricultural
SFPUC Supplies to Local Retailers[4]	43,300	0	43,300	Metered	Within 1.5%	Surface water reservoirs[5]	M&I
Recycled Water	15,200	1,900	17,100	Metered	Variable[6]	Treated wastewater	M&I and agricultural
Total[7]	**229,400**	**45,600**	**275,000**				

[1] All water use values are rounded to the nearest hundred.
[2] Production from some smaller wells and raw surface water users is estimated using a table of average uses or crop factors.
[3] Groundwater use by sector is shown in Table 1.
[4] San Francisco Public Utilities Commission (SFPUC) supplies water to eight (8) retailers in Santa Clara County and NASA-AMES (https://sfwater.org/index.aspx?page=355).
[5] SFPUC primary sources are surface water reservoirs with runoff mainly from the Hetch Hetchy watershed and also from the Alameda and Peninsula watersheds. More information is available at: https://sfwater.org/index.aspx?page=355.
[6] Recycled water meter accuracy varies as each of the four producers within the county uses different methods to measure production and delivery of recycled water.
[7] Local water rights used by the San Jose Water Company (SJWC) and Stanford within the Santa Clara Subbasin are not reflected in the total because their local water rights have historically amounted to <3% of the total for the Santa Clara Subbasin.

3.4 Change in Groundwater Storage

Due to good water supply conditions, robust managed recharge, and continued lower groundwater use since the drought, Valley Water estimates a net increase in countywide groundwater storage of 18,000 AF in WY 2019 compared to WY 2018. Storage increased by 11,400 AF in the Santa Clara Subbasin and by 6,600 AF in the Llagas Subbasin. Groundwater storage is the primary trigger for action under Valley Water's Water Shortage Contingency Plan, and storage remained well in the "Normal" stage (e.g., no shortage response required) in WY 2019.

Figure 8 depicts the change in groundwater elevation from October 2018 to September 2019 at more than 200 principal aquifer water level wells in the Santa Clara Subbasin and more than 45 wells in the Llagas Subbasin, respectively. The corresponding change in storage of 18,000 AF for the Santa Clara and Llagas subbasins, as estimated from Valley Water's calibrated groundwater flow models, is also shown in Figure 8.

Figures 9 and 10 present the water year type, groundwater use, annual change in groundwater storage, and cumulative change in groundwater storage for the Santa Clara and Llagas subbasins, respectively, from WY 1991 through WY 2019. These figures show that over this period, the annual change within each basin has most frequently been an increase in groundwater storage. The most notable exceptions, also evident in hydrographs, occur during droughts, as expected. However, Valley Water programs to recharge and manage groundwater support fairly rapid recovery of water levels and storage, helping ensure long-term sustainability. As mentioned previously, groundwater levels and storage in the Santa Clara and Llagas subbasins recovered from the 2012-2016 drought, with groundwater elevations far above historical minima and drought levels, and strong artesian pressures observed in the northern Santa Clara Subbasin.

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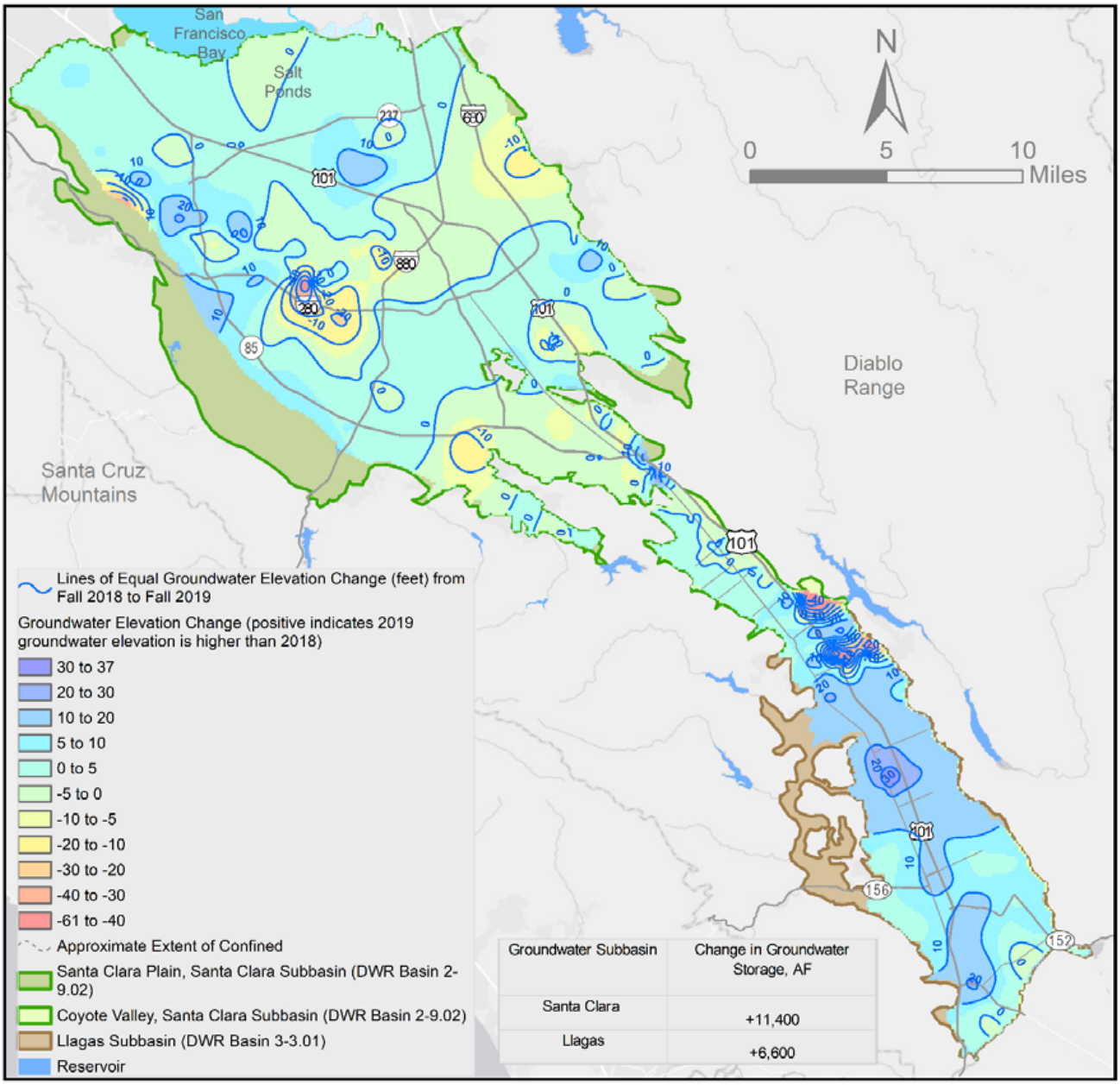
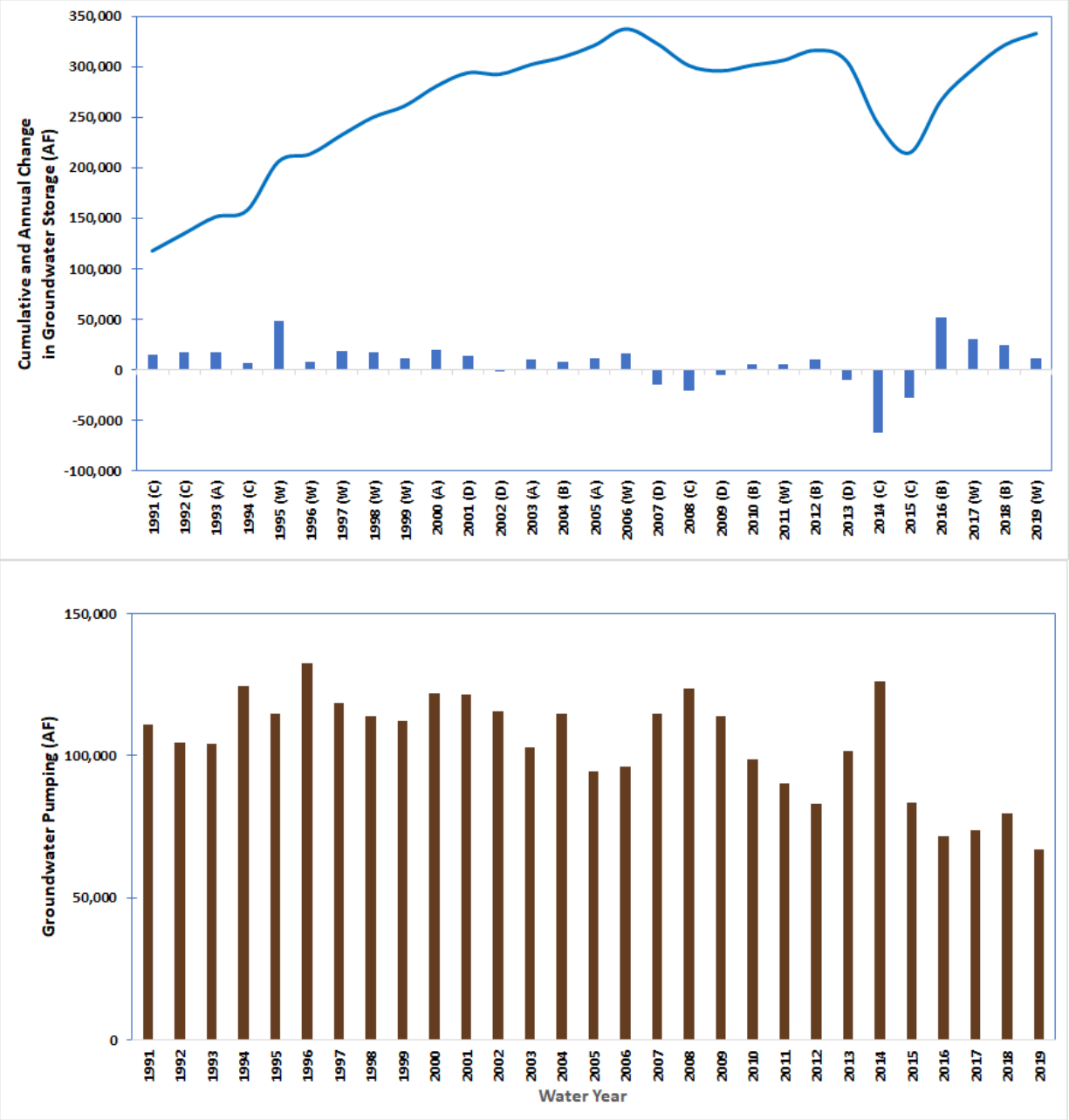
Figure 8. Change in Groundwater Elevation and Storage from October 2018 to September 2019



Groundwater Subbasin	Change in Groundwater Storage, AF
Santa Clara	+11,400
Llagas	+6,600

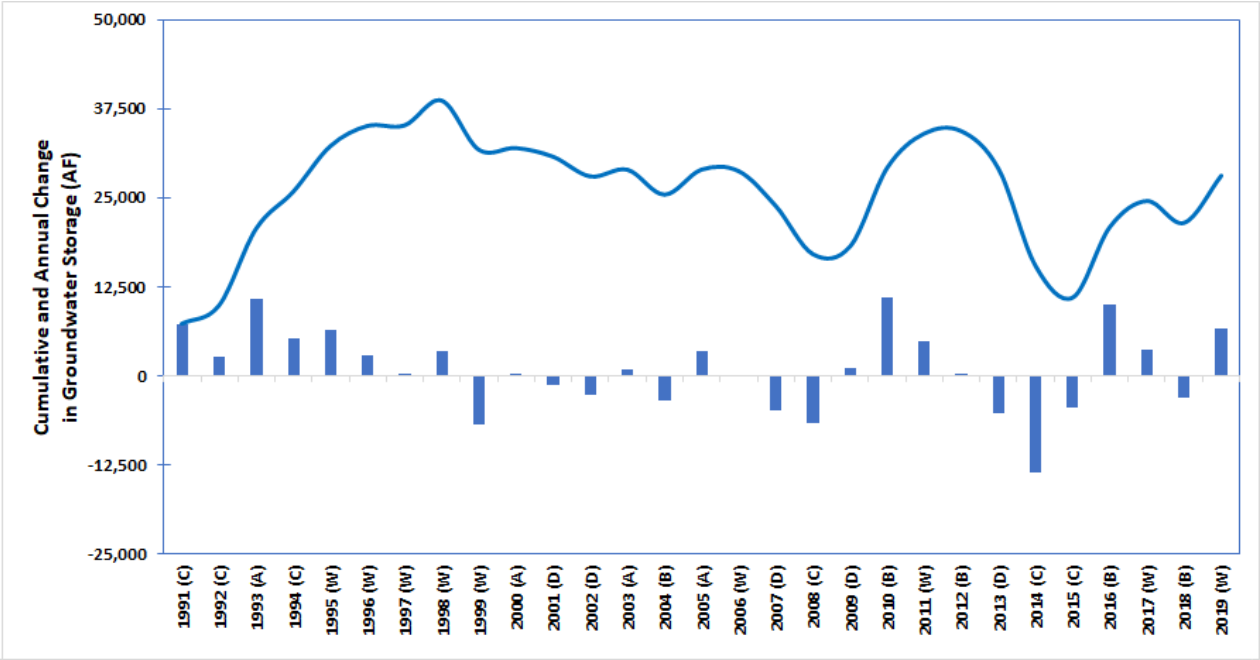
Figure 9. Groundwater Use and Change in Storage in the Santa Clara Subbasin

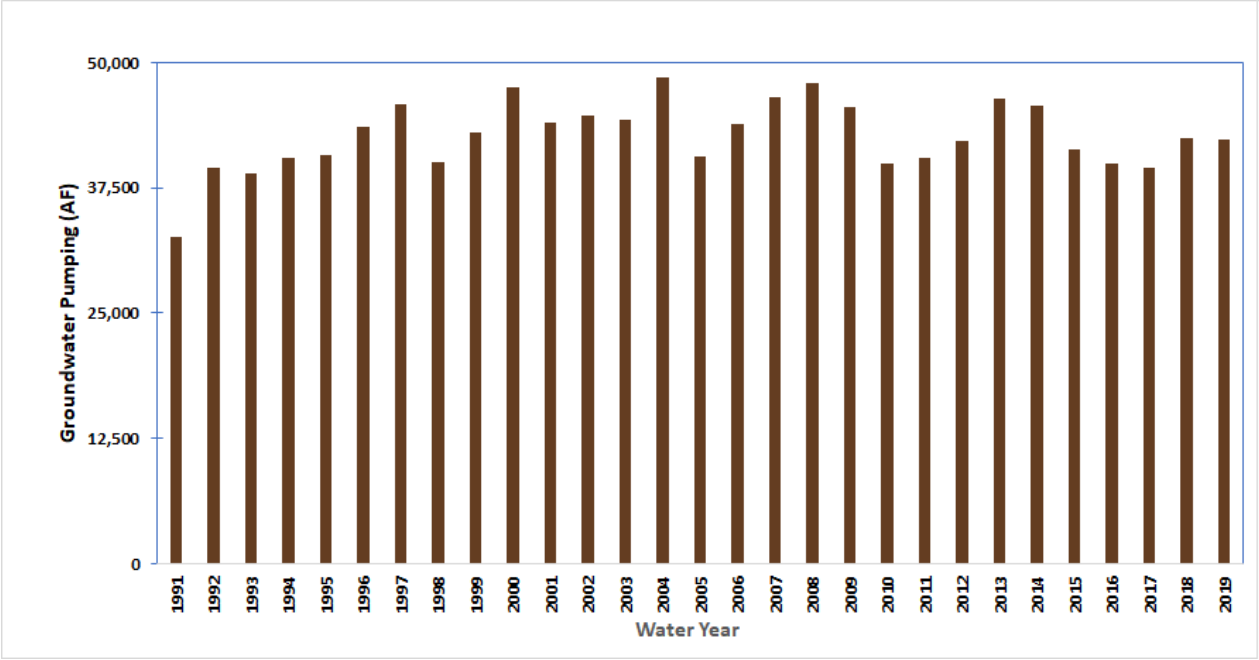


Notes:

- DWR SRI water year types are: Critical (C), Dry (D), Below Normal (B), Above Normal (A), and Wet (W).
- The storage graph begins in 1991 because Valley Water estimates Santa Clara Subbasin storage using two numerical models. The Santa Clara Plain model for the northern Santa Clara Valley begins in 1970 while the Coyote Valley model for the southern part of the subbasin begins in 1991 as Valley Water did not begin managing that area until the late 1980s.
- Most groundwater pumping is reported monthly and is reported here by water year. However, pumpers that report semi-annually or annually provide data based on the fiscal year (July 1 to June 30). For these reporters, groundwater pumping shown in this figure represents the fiscal year, which is presumed to be similar to the water year.

Figure 10. Groundwater Use and Change in Storage in the Llagas Subbasin





Notes:

- DWR SRI water year types are: Critical (C), Dry (D), Below Normal (B), Above Normal (A), and Wet (W).
- The storage graph begins in 1991 because Valley Water estimates Llagas Subbasin storage using a numerical model that begins in 1991 as Valley Water did not begin managing that area until the late 1980s.
- Most groundwater pumping is reported monthly and is reported here by water year. However, pumpers that report semi-annually or annually provide data based on the fiscal year (July 1 to June 30). For these reporters, groundwater pumping shown in this figure represents the fiscal year, which is presumed to be similar to the water year.

CHAPTER 4 – PLAN IMPLEMENTATION

Valley Water continues to implement the comprehensive conjunctive management, groundwater monitoring, and groundwater protection programs described in the Plan. As a result, groundwater levels and storage in the Santa Clara and Llagas subbasins fully recovered to pre-drought conditions and remain healthy and sustainable.

The Plan presents six major recommendations to maintain the long-term viability of groundwater resources. A summary of the status of each recommendation is below.

1. **Maintain existing conjunctive water management programs and evaluate opportunities for enhancement or increased efficiency.**

   This Plan recommendation has several sub-recommendations, including items related to infrastructure reliability, high-priority capital project implementation, and securing imported water sources, among others. Valley Water continues to focus on extensive groundwater recharge through direct replenishment and in-lieu recharge. Updates relative to this Plan recommendation are presented below.

   Capital Projects Supporting Conjunctive Management
   Valley Water continues to implement a comprehensive Capital Improvement Program (CIP). Valley Water's Fiscal Year Draft 2021-25 Five-Year CIP was approved for release on February 25, 2020.[10] With a significant portion of Valley Water's water supply infrastructure approaching fifty to sixty years of age, maintaining and upgrading the existing infrastructure to ensure each facility functions as intended for its useful life became the focus of the Water Supply CIP in recent years. Other CIP projects focus on expanding in-lieu and direct recharge through recycled and purified water projects. Major water supply capital improvements identified in the CIP include:

   Storage:
   - Almaden Dam Improvements
   - Anderson Dam Seismic Retrofit
   - Calero Dam Seismic Retrofit
   - Guadalupe Dam Seismic Retrofit
   - Pacheco Reservoir Expansion

   Transmission:
   - 10-Year Pipeline Rehabilitation
   - Fisheries and Aquatic Habitat Collaborative Effort (FAHCE) Implementation
   - Vasona Pumping Plant Upgrade
   - Almaden Valley Pipeline Replacement

[10] The draft 2021-25 CIP is available at: https://www.valleywater.org/how-we-operate/five-year-capital-improvement-program

Treatment:
- Penitencia Water Treatment Plant Residuals Management
- Rinconada Water Treatment Plant Reliability Improvement
- Santa Teresa Water Treatment Plant Filter Media Replacement
- Water Treatment Plant Electrical Improvement

Recycled Water:
- Expedited Purified Water Program
- South County Recycled Water Pipeline

Detailed information on each of these water supply capital projects, including related description, costs, and schedule, is available in the CIP.

2. **Continue to aggressively protect groundwater quality through Valley Water programs and collaboration with land use agencies, regulatory agencies, and basin stakeholders.**

Sub-recommendations from the Plan include continued groundwater quality monitoring, action when potentially adverse trends are identified, and continued/enhanced collaboration with local partners and stakeholders.

Groundwater quality is typically very good in the county, with no treatment beyond disinfection required at major retailer wells. However, nitrate remains an ongoing groundwater protection challenge, particularly in the more rural Coyote Valley and Llagas Subbasin. Valley Water continues to conduct extensive groundwater quality monitoring, evaluate long-term trends, and compare current conditions against regulatory standards and projected concentrations (such as from Salt and Nutrient Management Plans). Detailed information and analysis of all monitoring data is presented in Valley Water's Annual Groundwater Report, which is calendar-year based and published each summer.[11]

Long-term trends are favorable for nitrate, with about 90% of wells tested showing stable or decreasing concentrations. However, since a significant number of domestic wells in the Llagas Subbasin still contain nitrate above the drinking water standard, more work remains to be done. Valley Water offers rebates of up to $500 for nitrate treatment systems and will continue to engage with regulatory and land use agencies to address existing nitrate contamination. For nitrate and other water quality issues, Valley Water will work to build and enhance this collaboration to protect high-quality groundwater and expedite the restoration of impacted groundwater.
In 2019, Valley Water worked with land use agencies to finalize a Stormwater Resources Plan[12] that will increase infiltration while ensuring pollutants from urban runoff are not merely transmitted from surface water

[11] The comprehensive Annual Groundwater Report for each calendar year is available at www.valleywater.org/groundwater.
[12] Santa Clara Basin Stormwater Resource Plan, Final August 2019 is available at https://scvurppp.org/wp-content/uploads/2019/08/SCB_SWRP_FINAL_8-20-19.pdf

to groundwater. Similarly, Valley Water continues to engage with various entities to ensure that recycled water expansion or the use of purified water for recharge will be protective of groundwater quality.

Engaging with land use and regulatory agencies on proposed policy, legislation, and projects that may impact groundwater remains a key strategy for protecting groundwater. For example, Valley Water tracks the progress of major contaminant release sites, interacting with regulatory agencies to promote expedited and thorough cleanup. Valley Water also engages with land use agencies on relevant projects and policies such as development, stormwater infiltration devices, septic systems, and small water systems.

Public outreach continues to be an important component of Valley Water's groundwater protection efforts. In WY 2019, Valley Water celebrated Groundwater Awareness Week by highlighting groundwater on the Valley Water website and posting related social media messages. Valley Water also maintained its status as a Groundwater Guardian through a program sponsored by the non-profit Groundwater Foundation. This is an annually earned designation for communities and affiliates that take voluntary, proactive steps toward groundwater protection.

To provide information on well sampling by Valley Water and local water suppliers, Valley Water prepared the 2018 Groundwater Quality Summary.[13] This annual report is similar to water retailer consumer confidence reports and provides basic groundwater quality information to domestic well owners who do not typically receive water from a water retailer.

Other groundwater-related public outreach conducted by Valley Water in WY 2019 included:

- Interaction with thousands of students through the Education Outreach program.
- Direct communication with well owners on groundwater quality, well maintenance, and treatment systems under the Domestic Well Testing and Nitrate Treatment System Rebate programs.

3. Continue to incorporate groundwater sustainability planning in Valley Water planning efforts.

This Plan recommendation focuses on continued, thoughtful water supply planning and investments. In November 2019, Valley Water completed an update to the Water Supply Master Plan 2040[14], which explains Valley Water's strategy for providing a reliable and sustainable water supply into the future. The Water Supply Master Plan 2040 informs investment decisions and provides a framework for annually monitoring the water supply strategy to ensure it will meet the water needs of Santa Clara County. Staff held multiple workshops with water retailers and stakeholders and presented information to the Board and the Board's Water Conservation and Demand Management Committee on numerous occasions. These presentations have included information on the proposed level of service goal and potential water supply investment strategies. The Valley Water

[13] The 2018 Groundwater Quality Summary Report is available at https://www.valleywater.org/sites/default/files/2019-07/2019%20Groundwater%20Quality%20Report%20Shell_Web_Version_0.pdf
[14] Santa Clara Valley Water District, Water Supply Master Plan 2040 is available at https://www.valleywater.org/sites/default/files/Water%20Supply%20Master%20Plan%202040_11.01.2019_v2.pdf

investment strategy includes securing existing supplies, expanding water conservation and reuse, and optimizing the system. Projects approved by the Board for planning include advanced metering infrastructure, leak repair incentives, expansion of Valley Water's graywater program, a model water-efficient ordinance for new developments, decentralized stormwater capture (e.g., incentives for rain barrels, cisterns, and rain gardens), and centralized stormwater capture (e.g., flooding of agricultural lands), 24 thousand acre-feet of potable reuse, the Delta Conveyance Project, expanding Pacheco Reservoir, and the Transfer-Bethany Pipeline. Details about each of these projects can be found in Appendix H of the Water Supply Master Plan 2040.

Groundwater sustainability also remains an important factor during the planning and implementation of multi-benefit projects under Valley Water's One Water Plan[15]. The Sustainable Groundwater and Water Quality objectives of the One Water Plan align with the Plan outcome measures and the process to identify individual projects on the watershed scale (e.g., Coyote Watershed) accounts for groundwater conditions and sustainability.

To support managed response to climate change, Valley Water is developing a Climate Change Action Plan (CCAP) that will be completed in 2020. The CCAP will include comprehensive review of climate change as it relates to Valley Water core services and include goals, strategies, and possible actions to respond to climate change. The CCAP will identify potential future climate change vulnerabilities and risks to all core service areas, including water supply and groundwater management. The CCAP will provide goals and strategies to reduce risks to Valley Water core services and its mission. The strategies will be incorporated into existing Valley Water plans, budgets, and long-term financial forecasts as appropriate.

4. Maintain adequate monitoring programs and modeling tools.

This Plan recommendation focuses on improving monitoring networks by identifying and addressing gaps, redundancies, and access issues; identifying and implementing improvements to the numerical groundwater flow models; and improving Valley Water's understanding of surface water/groundwater interaction and groundwater dependent ecosystems (GDEs). In addition to the comprehensive, calendar-year based Annual Groundwater Report, Valley Water produces high-level monthly Water Tracker[16] and groundwater condition reports[17] help keep stakeholders informed about current groundwater conditions including groundwater pumping, recharge, and water levels.

Valley Water continues to offer free basic well testing for domestic well owners to supplement regional groundwater quality monitoring, which emphasizes the use of consistent wells. Through this voluntary program, Valley Water obtains valuable data on nitrate and other contaminants while providing important water quality data to about 200 private well owners each year. Valley Water is evaluating the recycled water and recharge

[15] https://onewaterplan.wordpress.com/
[16] https://www.valleywater.org/your-water/water-supply-planning/monthly-water-tracker
[17] https://www.valleywater.org/your-water/where-your-water-comes-from/groundwater/groundwater-monitoring

water quality monitoring networks to ensure they meet monitoring objectives in terms of frequency, locations, and constituents analyzed.

Valley Water uses three calibrated groundwater flow models – one for each groundwater management area (Santa Clara Plain, Coyote Valley, and the Llagas Subbasin). These models are used to evaluate groundwater storage and levels to inform operational decisions and long-term planning efforts. Staff is assessing each model to identify related improvements or enhancements that may be needed or desired to improve the use of these tools.

Regarding surface water/groundwater interaction, Valley Water staff has begun to evaluate existing available data for stream gauging and groundwater levels. Valley Water is also evaluating whether existing wells adjacent to creeks may be useful in collecting additional data to better understand the interaction. Staff has attended workshops organized by DWR and reviewed both relevant literature and how other GSAs are working to better understand groundwater-surface water interaction. Staff has also performed preliminary experiments to measure the flux between surface water and groundwater. Valley Water will continue to explore the complex and dynamic interaction between surface water and groundwater and will engage interested stakeholders. This issue will be further documented in the five-year Groundwater Management Plan update, which is due by January 1, 2022.

5. **Continue and enhance groundwater management partnerships with water retailers and land use agencies.**

This Plan recommendation focuses on continued collaboration and strong partnerships with water retailers and land use agencies. Valley Water continues to interact regularly with water retailers through quarterly Water Retailer meetings, including the Groundwater Subcommittee. In addition to these regular meetings, Valley Water and water retailers collaborate on various issues that arise regarding groundwater, treated water, wells, and water measurement.

Valley Water also continues to coordinate with local land use agencies on General Plans, water supply assessments, Urban Water Management Plans, stormwater management, and various individual land use projects. Land use decisions fall under the authority of the local cities and the County of Santa Clara. Valley Water reviews land use and development plans related to Valley Water facilities and watercourses under Valley Water jurisdiction and provides technical review for other land use proposals as requested by the local agency. When provided by land use agencies, water supply assessments for new developments are also reviewed and evaluated in the context of Valley Water's long-term water supply plans. For all reviews, Valley Water's groundwater-related comments focus on potential impacts to groundwater quality and sustainability.

6. Evaluate the potential new authorities provided by SGMA.

The Santa Clara Valley Water District Act provides broad authorities, but there are additional authorities under SGMA including the ability to regulate pumping or impose various types of fees. This Plan recommendation focused on the evaluation of these new SGMA authorities in cooperation with water retailers and other interested stakeholders to consider what conditions might necessitate their implementation to sustainably manage groundwater into the future.

As first described in the WY 2017 Annual SGMA Report submitted to DWR, Valley Water has explored new SGMA authorities with interested stakeholders through the Board's Water Conservation and Demand Management Committee (Committee). Nine publicly noticed Committee meetings between December 2016 and December 2017 provided a transparent forum for discussion with interested stakeholders on how and when these authorities might be used.

The potential regulation of pumping or well construction is a complex and controversial topic, which was discussed extensively through Committee meetings. Existing groundwater management programs and strong partnerships with large pumpers are expected to result in continued sustainable conditions and are the preferred way to address future challenges. However, pumping regulation may be needed in the future to address undesirable results. The primary SGMA-related work product from the Committee meetings was a process that describes the fundamental approach to respond to potential worsening basin conditions. This includes the steps that would be taken prior to implementing SGMA authorities to regulate groundwater pumping, with a focus on providing some certainty on the process, while avoiding prescriptive requirements that may not be effective in addressing a future issue. This process was memorialized via a resolution adopted by Valley Water Board on February 27, 2018. This resolution was included as Attachment 2 in the WY 2018 Annual SGMA report to DWR.

Valley Water also explored the potential to implement a fixed charge as a component of groundwater production charges, which are currently volumetric charges. This could potentially reduce volatility in rates and revenues based on changes in water use. Valley Water engaged a consultant to develop a fixed charge proposal and assist with implementation. However, major water retailers expressed significant concerns, including redundancy with other charges or charge adjustment mechanisms, equity in applying the charge to all well users, and potential cost recovery impacts to retailers regulated by the California Public Utilities Commission. After discussing these concerns with the Committee and the full Board, Valley Water is unlikely to further pursue a fixed charge at this time.

NEXT STEPS

Valley Water will continue to submit annual reports required under SGMA to DWR by the April 1 deadline. In addition to this brief report, Valley Water will also continue to publish a comprehensive, calendar-year based Annual Groundwater Report each summer with more detailed information on pumping, recharge, water balance, groundwater levels and storage, land subsidence and groundwater quality. The most recent report, the Annual

Groundwater Report for Calendar Year (CY) 2018, is posted on the Valley Water website, and will be replaced with the CY 2019 Report in the summer of 2020.[18]

Ensuring continued groundwater sustainability is central to the Valley Water mission to provide Silicon Valley a safe, clean water supply for a healthy life, environment, and economy. As such, Valley Water will continue to "aggressively protect groundwater from the threat of contamination and maintain and develop groundwater to optimize reliability and to minimize land subsidence and salt water intrusion," in accordance with Board policy.

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[18] https://www.valleywater.org/your-water/where-your-water-comes-from/groundwater

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